JANUARY, 1939

Rock Products

THE INDUSTRY'S RECOGNIZED AUTHORITY

ANNUAL ILLUSTRATED REVIEW AND DIRECTORY NUMBER

SMIDTH MACHINERY

FOR

CEMENT • LIME • ORE

The illustrations show some of the installations of Smidth machinery in various countries. Space does not permit showing all. However, Smidth machinery has been supplied to

64 COUNTRIES OF THE WORLD

250
UNAX ROTARY KILNS
have been installed throughout the world

650
UNIDAN MILLS
have been installed throughout the world

In addition to rotary kilns and Unidan Mills, Smidth equipment includes a complete line of machinery, such as ballmills, tubemills, coolers, agitators, washmills, pumps, conveyors, feeders, seperators, etc., with accessories, for use in Cement, Lime and Ore plants

F. L. SMIDTH & Co.

Engineers

[illegible] BROADWAY NEW YORK, N. Y.

McLANAHAN

SHOWING A FEW 1938 INSTALLATIONS OF McLANAHAN EQUIPMENT

Heavy duty reciprocating feeder delivering shovel loaded limestone to McLanahan 30 x 36 giant all steel primary crusher in an Iowa mine at left.

Two pairs of modern log washers in Penna. plant at right removing tough clay and soft rock from 1600 tons of limestone daily.

Sized limestone desired is delivered by conveyor from plant bin to log washer. Clean product by elevator to loading bin.

Primary single roll crusher receiving shovel loaded limestone from McLanahan feeder.

Black Diamond primary crushing Iowa gypsum in plant at left.

McLanahan heavy duty feeder delivering shovel loaded limestone to number 30 gyratory.

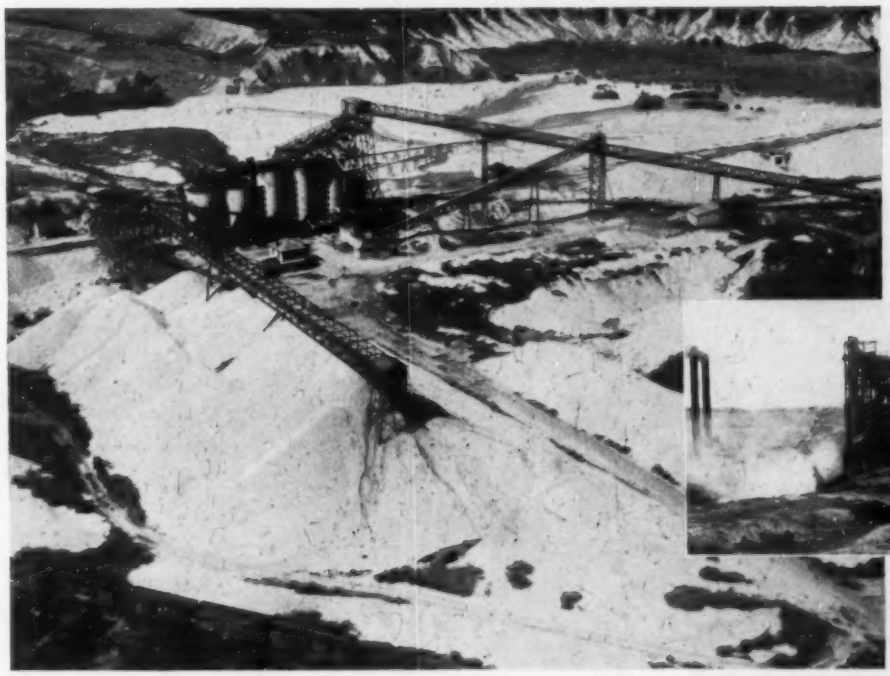
Single roll primary followed by double roll reduction crusher on Texas rock.

Heavy duty 30 foot log washer removing tough clay from Tennessee phosphate rock.

McLANAHAN AND STONE CORPORATION

TN950
.A3

Engineered for Low-Cost Results when Designed by LINK-BELT



Left: Airplane view of McGrath Sand and Gravel Co's., Chillicothe, Ill. plant. One of ten Link-Belt plants designed and built for this company.

McGrath's original Chillicothe, Ill. plant. Designed and built by Link-Belt in 1914. Remodeled and electrified in 1922 and replaced in 1933 with the modern steel and concrete plant, shown to the left.

1939
NEW YORK WORLD'S FAIR EXHIBITOR METALS BLDG.

● Link-Belt has not only brought to a high state of perfection the design of the various units entering into a complete preparation plant, but has paid particular attention to the proper application of these units. Plant layout is all-important. Misapplication of equipment results in inefficiency, high operating costs, and an unsatisfactory product.

Let Link-Belt bring its engineering skill and experience to bear on your problem. The sole objective is to help you turn out a clean, uniform product at the lowest cost. Link-Belt manufactures in its own shops a complete line of all types of screens, washers, conveyors, elevators, etc., and is, therefore, free to recommend the type and method that will fit the particular conditions best. Send for Book No. 1240.

Link-Belt Company, 300 W. Pershing Road, Chicago; Indianapolis, San Francisco, Philadelphia, Atlanta, Toronto. Offices in Principal Cities.

7561

LINK-BELT

Preparation - - Conveying - -

Power Transmitting Equipment

JAN 16 1939
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Rock Products

With which has been consolidated the journals

CEMENT and ENGINEERING NEWS CONCRETE PRODUCTS

Founded 1896 Est. 1918

Recognized the World Over as the Leader in Its Field

VOL. 42 CHICAGO, JANUARY, 1939 No. 1

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ROCK PRODUCTS
Bears the Twin Hall-Marks of Known Value

Impartial measurement of reader interest in terms of paid circulation

Authentic facts relating to editorial scope and readership analysis

Entered as second-class matter, Jan. 30, 1936 at the Chicago, Ill., postoffice, under the Act of March 3, 1879. Copyrighted, 1939, by Tradepress Publishing Corporation (PUBLISHED MONTHLY).

JAEGER again steps ahead with the most important truck mixer improvement in 8 years . . .

1.

SYPHO-METER WATER TANK

accurate within a fractional percent of tank capacity regardless of tank position or splashing on rough roads. Valve can even be left open on long hauls with perfect safety.

2.

DUAL REVOLVING WATER SPRAYS

Giving 100% Faster, Uniform Water Distribution — Clear Path as They Revolve, Spray Into and Over Mass in both directions, from end to end of drum!

3.

Combine with Jaeger Reversing, End-to-End Mixing Action to insure a Higher Strength, More Uniform, More Workable and

MORE SALABLE CONCRETE

Even on the Shortest Hauls.

END - TO - END REMIXING with 100% FASTER and UNIFORM DISTRIBUTION OF WATER – the 1939 METHOD

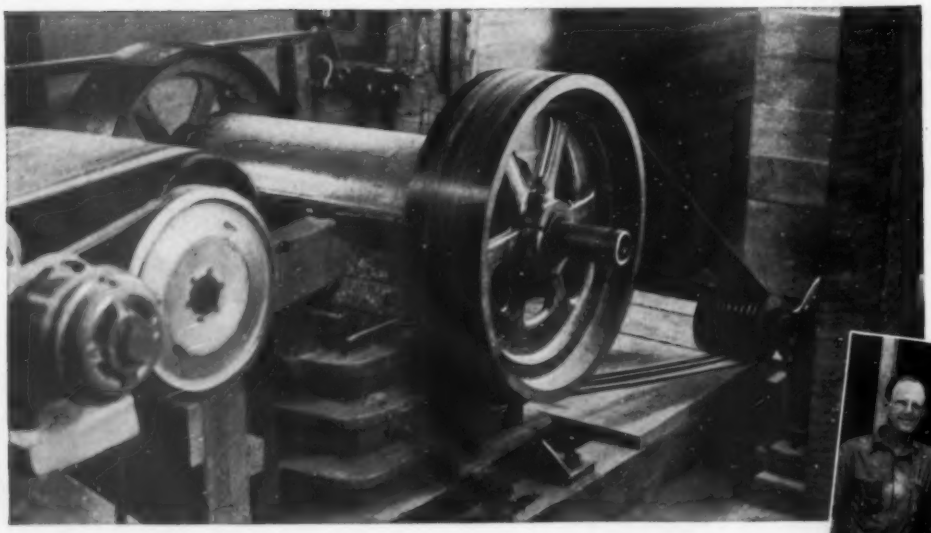
Jaeger 1939 Model Truck Mixers are ready--ready with fundamental advances in truck mixer design --ready to produce the highest quality transit-mixed concrete ever offered to contractors, architects and engineers--ready to win customers and profits for Jaeger operators in one of the most actively expanding industries in America today.

Our new bulletin "ADVANCE INFORMATION ON JAEGER 1939 MODEL TRUCK MIXERS" gives full details. Send for your copy--today.

THE JAEGER MACHINE CO.
603 Dublin Avenue Columbus, Ohio

South Carolina Gold Mine

GETS THE HELP THAT COUNTS



Left. Belt conveyor and crusher unit, Texaco lubricated, in plant of Haile Gold Mine, South Carolina.

Three of the key men in crew at Haile Gold Mine in South Carolina. These men give credit to Texaco Lubricants for smooth operation under severe conditions.

YES SIR, IT'S IN SOUTH CAROLINA. Since 1928, The Haile Gold Mine, Kershaw, S. C., produced upwards of $5,000,000 worth of gold.

The present operation features the most modern metallurgical practice. From Mine Manager Edmund Newton's letter:

> "It has not been simply an accident that we decided on TEXACO products. We studied our requirements carefully and the TEXACO engineers have made many helpful recommendations. Not only do the products have the right characteristics for our service, but the entire personnel of THE TEXAS COMPANY has shown an excellent spirit of cooperation with us. It is truly a pleasure to do business with your Company."

Texaco Industrial Lubricants exclusively are in use here, among them Texaco Algol Oil for air compressor and gas engine lubrication.

To get improved results in your organization, get in touch with us. Our lubrication engineers will cooperate with your people in the selection and application of Texaco Lubricants.

2186 warehouses assure prompt deliveries. To order, phone the nearest, or write: The Texas Company, 135 East 42nd Street, New York City.

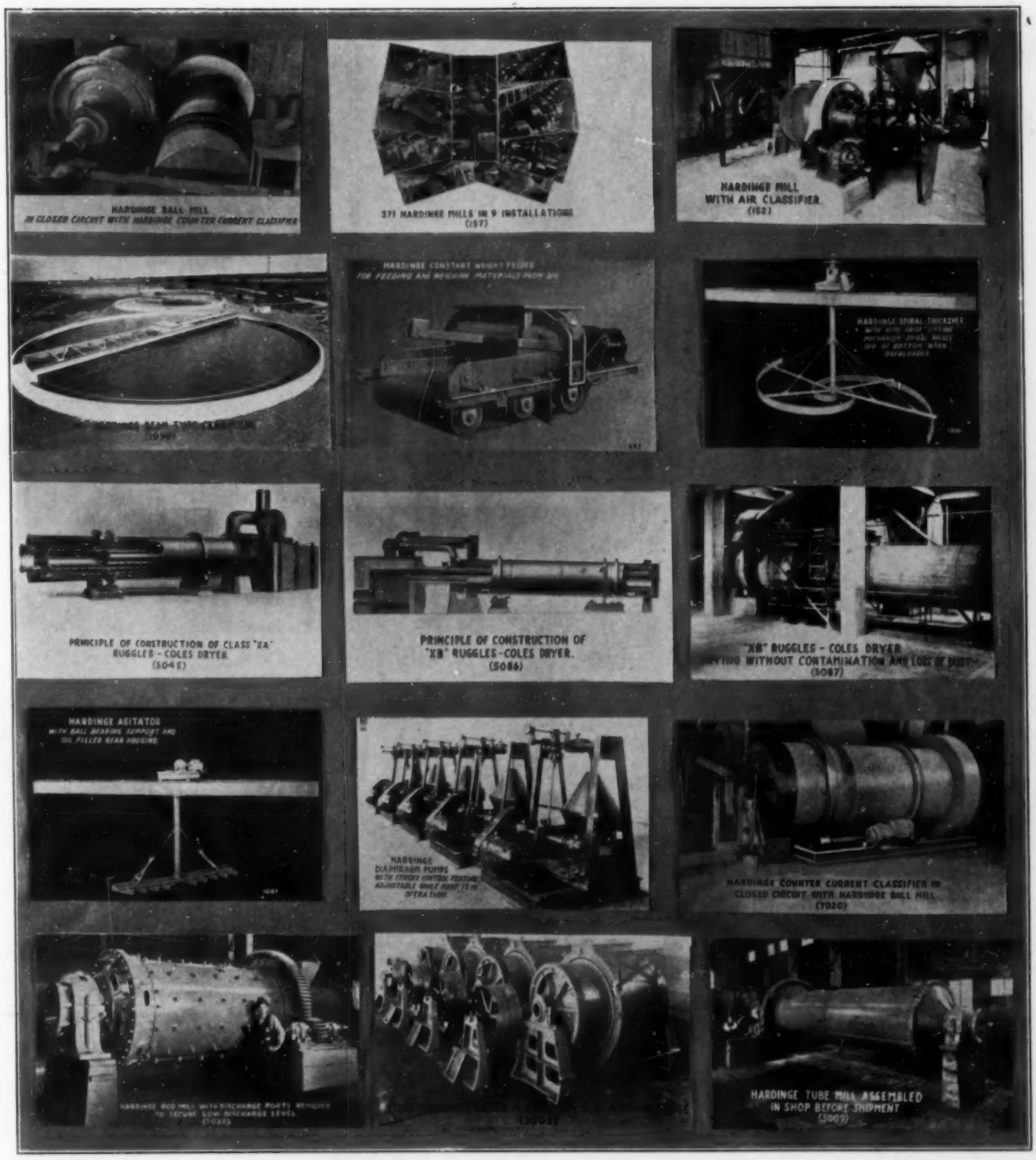
TEXACO

REG T.M.

TEXACO Algol and Ursa Oils

FOR COMPRESSOR LUBRICATION

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment—Every Wednesday Night—Columbia Network — 9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.



HARDINGE

COMPANY, INCORPORATED – YORK, PENNSYLVANIA

New York, 122 East 42nd Street Chicago, 205 West Wacker Drive San Francisco, 501 Howard Street Denver, 817 Seventeenth Street

CONICAL MILLS | COUNTER CURRENT CLASSIFIERS | THICKENERS CLARIFIERS | RUGGLES-COLES DRYERS | CONSTANT WEIGHT FEEDERS | TUBE ROD AND BATCH MILLS

THE MOST *Economical* ROCK DRILLING TOOL

TIMKEN Bearings are used on all locomotives and many of the cars of the new 20TH CENTURY LIMITED

Mine and quarry operators who have adopted TIMKEN Rock Bits have found them to be the most economical rock drilling tools they have ever used.

Apart from the considerable savings brought about by the removable feature, including the elimination of reforging and the radical reduction of nipping, TIMKEN Bits possess inherent advantages that cut drilling costs to the bone.

They drill faster, because of their scientific design and unique shoulder construction which distributes the drill blows evenly to all cutting edges.

They last longer because they are made of TIMKEN Electric Furnace Steel heat treated and deep hardened by the same methods used in manufacturing TIMKEN Bearings, thus presenting greater resistance to abrasion and wear.

Sooner or later you will see the advisability of adopting removable rock bits. When you do, be sure you get *all* the benefits they afford. You will get them all with TIMKEN Rock Bits. Write for further information.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
ROCK BITS

This high-stepping crusher is the center of attraction all down the line, and as the procession advances the first division is constantly being augmented by operators in the stone crushing, sand and gravel, lime and cement manufacturing, chemical and mining industries.

One principal reason for the triumphal march of the Traylor Type TY Reduction Crusher is that it performs spectacularly, yielding profits in greater volume than purchasers expect, which, in the last analysis, is the truest measure of merit of any machine.

Get acquainted with this crusher—share those extra profits at no added cost. See our Bulletin 2112.

TRAYLOR ENGINEERING & MANUFACTURING CO.

ALLENTOWN, PENNSYLVANIA, U. S. A.

NEW YORK CITY — CHICAGO — SALT LAKE CITY — LOS ANGELES — SEATTLE

BOWL MILL

LUBRICATION

Spiral pump oiling systems automatically lubricate the roller journals and the main shaft. The surest lubrication ever built into a mill

MOTOR . . .

Mill and fan driven by one constant-speed direct-connected standard motor — no belts, no idlers, no special motor shaft.

FAN . . .

Operates on suction side of mill, handling constant temperature air and giving a uniform, intimate air-coal mixture for maximum combustion efficiency.

IF THIS ○ ROLLS OVER THIS ■ EASIER

THAN THIS ○ ROLLS OVER THIS ■ THEN IT IS OBVIOUS

that the larger diameter grinding elements of the Bowl Mill require LESS POWER

Increased kiln production and improved quality of cement clinker at a reduced cost per barrel—these are the direct results of Bowl Mill firing. Due to the efficient pulverizing and classifying principle, uniform fineness is maintained at any rate of feed. The fineness is controlled within close limits at all times.

Thermostatic control of ingoing air is standard equipment on Raymond Bowl Mills. The outgoing temperature of the air-coal mixture is held constant regardless of the moisture content of the coal feed—result: uniform drying, efficient burning and better kiln performance.

RAYMOND PULVERIZER DIVISION
COMBUSTION ENGINEERING COMPANY, INC.
1307 North Branch Street CHICAGO

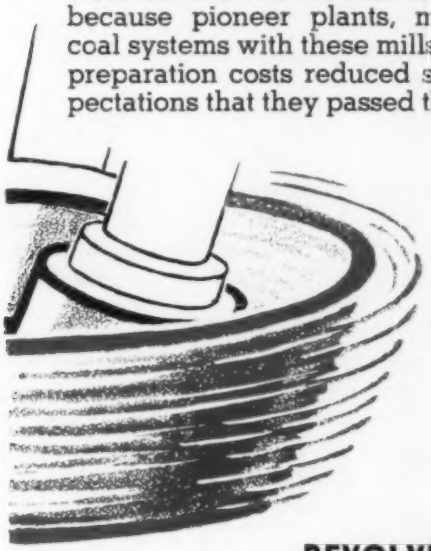
ECONOMIES... *Are Backed* BY FACTS

RAYMOND Bowl Mills challenge comparison on low operating costs—low power consumption — and low maintenance, based upon actual operating performance in recent direct-firing installations on rotary kilns.

When operating in the same plant with competitive grinding units and serving the same size kilns, the Bowl Mill shows as much as 30% savings in power.

Bowl Mill firing in a number of installations has reduced coal preparation costs as much as 40 per cent. Economies in fuel, power, labor and repairs, in terms of dollars and cents, have usually paid for the installation in less than 1-1/3 years.

It didn't just happen that over 250 Bowl Mills were installed in the first three years. It was because pioneer plants, modernizing their coal systems with these mills, found their coal preparation costs reduced so far beyond expectations that they passed the good word on.



ALL ADJUSTMENTS

for fineness, roll alignment, air-coal ratio, temperature control—and oiling—are made from the outside while the mill is operating.

THE COIN TEST . . .

Believe it or not—a coin on edge will remain standing upright on the top plate of the Bowl Mill [illegible] operation which shows—

SMOOTH, QUIET, VIBRATIONLESS OPERATION

The absence of metal-to-metal contact between grinding elements—the balanced design—the precision construction—ball and roller bearings—are the reasons why the Bowl Mill is the QUIETEST COAL PULVERIZER on the market. No special foundation nor cushioning pads are necessary.

WORM GEAR DRIVE . . .

Precision-built drive mechanism with gears running in a bath of oil. This assures SUSTAINED drive efficiency year in and year out.

REVOLVING BOWL

By this exclusive Bowl mill feature, the coal is instantly thrown between the rolls and the grinding ring by centrifugal force, giving maximum grinding efficiency with a minimum load of unground material.

AUTOMATIC TRAMP IRON DISPOSAL

Tramp iron, slate and pyrites are thrown out of the bowl and discharged automatically from the mill with no attention from the operator —an exclusive Bowl Mill feature.

Sales Offices in all Principal Cities

Canada: Combustion Engineering Corp., Ltd., Montreal

100% G-E INSTALLATION

at Longhorn Portland Cement

Continues to Give Low-cost Service

Notes On Trip Through Plant

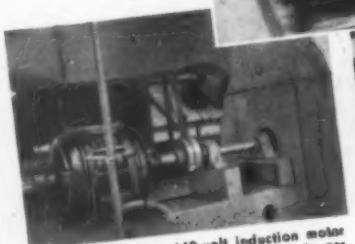
G-E equipped electric shovel loading Austin chalk into 8-ton cars

G-E 250-hp, 720-rpm, 2200-volt motor driving hammer-mill-type crusher

Four compeb mills—40 feet long—driven through one gear reduction by G-E synchronous motors

This G-E switchboard, 49 feet long, meters, distributes, and controls 3000 kva

Two G-E 75-hp, 1200-rpm, 440-volt motors driving slurry pumps. Agitator drive in background driven by G-E 7½-hp, 900-rpm, 440-volt motor



This G-E 900-rpm, 440-volt induction motor drives a 90-inch fan for delivering air to gas burners of kilns

One of two G-E 75-hp, 600/1200-rpm, 230-volt, d-c motors driving kilns

EQUIPMENT INCLUDES MOTORS, DISTRIBUTION TRANSFORMERS, SWITCHGEAR, CABLE, AND CONTROL

NINE years of grueling service have convinced the Longhorn Portland Cement Company that General Electric equipment can "take it." The company is thoroughly satisfied with the performance of the motors, control, switchgear, cable, and distribution transformers installed in its plant near San Antonio, Texas—a 100-per cent G-E installation.

Low Maintenance Costs

Longhorn quarries Austin chalk, which contains all the elements needed for a high-quality cement. The availability of this excellent raw material and of natural gas for firing the kilns made possible a remarkably simple and compact plant layout. The low maintenance and repair charges on the electric equipment have enabled Longhorn to take full advantage of these favorable conditions.

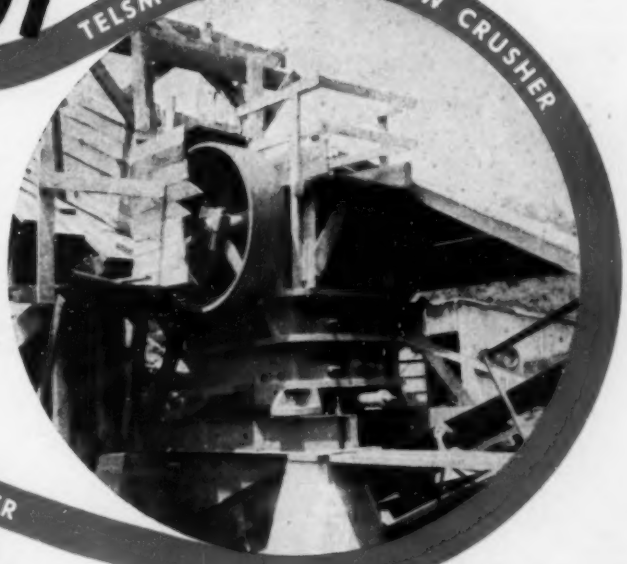
• • •

If you are considering building a new plant or installing new equipment in your present one, call in the nearest G-E representative. He will be glad to help you co-ordinate your electric power installation. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

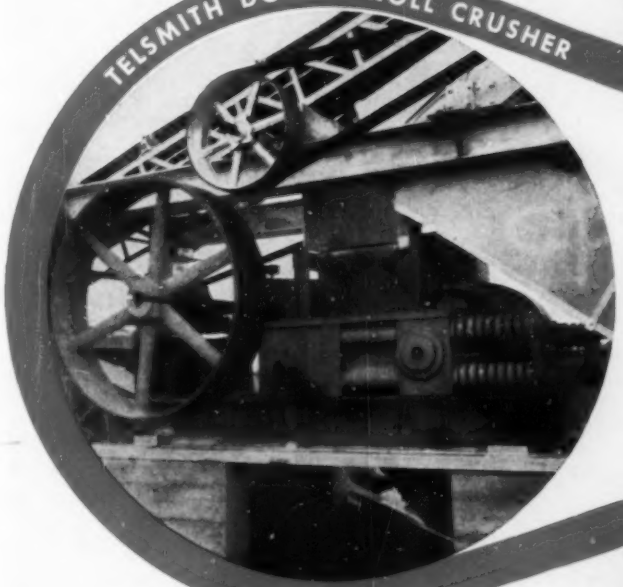
EXTRA OUTPUT

TELSMITH-WHEELING JAW CRUSHER



The most modern type of jaw crusher . . . for coarse or intermediate crushing . . . the Telsmith-Wheeling is equipped throughout with *cylindrical roller bearings.* This crusher delivers more crushing strokes per minute . . . almost double capacity . . . and greater reduction in one process than with any other type of breaker. All internal frictional wear is taken on the bearing races . . . no wear on shaft. Up-keep is reduced . . . service life prolonged. 7 sizes. *Write* for Bulletin W-11.

TELSMITH DOUBLE ROLL CRUSHER



EXTRA PROFITS

For large output of fine aggregate at reduction ratios not over 3:1, use the Telsmith Double Roll Crusher. It produces less oversize than any other type of secondary crusher. Its compact design saves head room and weight. Anti-friction bearings (running in oil) and spring release insure high speed, continuous, trouble-free operation. First cost is low, too. *Write* for Bulletin L-11.

TELSMITH PULSATOR

LOWER UP-KEEP

Sand, gravel, crushed rock, ore, coal—Telsmith Pulsator *screens 'em all,* wet or dry, and does it *right.* Its circular movement produces a maximum screening action that's *uniform* on every inch of the wire, regardless of load. Telsmith builds in greater value, longer life and lower up-keep with the toughest alloy steels, anti-friction bearings, and special seal protection for working parts. 11 sizes . . . 1, 2, 3 and 4 decks. *Write* for Bulletin V-11.

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508 EAST CAPITOL DRIVE, MILWAUKEE, WISCONSIN
Cable Addresses: Sengworks, Milwaukee — Concrete, London
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713 Commercial Trust Building, Philadelphia, Pa.
81 Binney Street, Cambridge, Mass.
412 Westinghouse Bldg., Pittsburgh, Pa.
Brandeis M. & S. Co., Louisville, Ky.

MC-10

TELSMITH

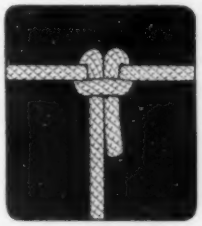
This automatic heat control operates so delicately that the temperature within the furnace never varies more than a small fraction of one percent.
YOUR ROPE COSTS ARE DETERMINED IN OUR PATENTING FURNACE
BUILDING LIFE INTO WICKWIRE ROPE "BEYOND SPECIFICATIONS" . . . . . .
To fully appreciate the importance of control in heat treatment of rope wire, the user of rope must consider the value to him of consistent rope performance. In the patenting furnace are built the structures that give a rope long life, freedom from fatigue, and uniformity. Variations in temperature materially change these characteristics. Therefore Wickwire Spencer has spared no expense in determining what the proper temperatures should be and in equipping their furnaces with automatic controls that eliminate the unreliability of hand operation.
WICKWIRE ROPE
It is still the privilege of the progressive manufacturer to build rope life into his product beyond official specifications.
WICKWIRE SPENCER STEEL COMPANY
General Offices: 41 East 42nd Street, New York City; Sales Offices and Warehouses: Worcester, New York, Chicago, Buffalo, San Francisco, Los Angeles, Tulsa, Chattanooga, Houston, Abilene, Texas, Portland, Seattle. Export Sales Department: New York City

Primacord--Reinforced* for a Tough Job

Here's a piece of Primacord, ready to go to work. It is merely tied into a cartridge—no primer is needed because Primacord-Bickford is a *detonating* fuse.

After the cartridge has been lowered to the bottom of the hole, and the hole loaded and tamped, the Primacord will be tied with a tight half hitch to the main line. The entire blast, which may consist of any number of holes, can then be detonated from a single cap on the main line.

Primacord-Bickford has a core of PETN within a waterproof textile covering. It is furnished in three grades: Plain, Reinforced (*illustrated), and Wire Bound. It is insensitive, light in weight, flexible, strong. And its use in modern blasting leads to many savings in money, time and labor. Send for a copy of the Primacord Book.



THE ENSIGN-BICKFORD CO., SIMSBURY, CONN., U. S. A.
Makers of Cordeau-Bickford Detonating Fuse—and Safety Fuse Since 1836

PRIMACORD-BICKFORD *Detonating Fuse*

PB4

MANITOWOC ENGINEERING WORKS

Division of Manitowoc Shipbuilding Co.

General Offices and Plant: Manitowoc, Wis. Chicago Office: 131 E. Wacker Dr.

DESIGNED AND BUILT BY M MANITOWOC

Vanderwerp Recuperators

Vanderwerp Coolers

Minogue Agitators

Minogue Kiln Feeders

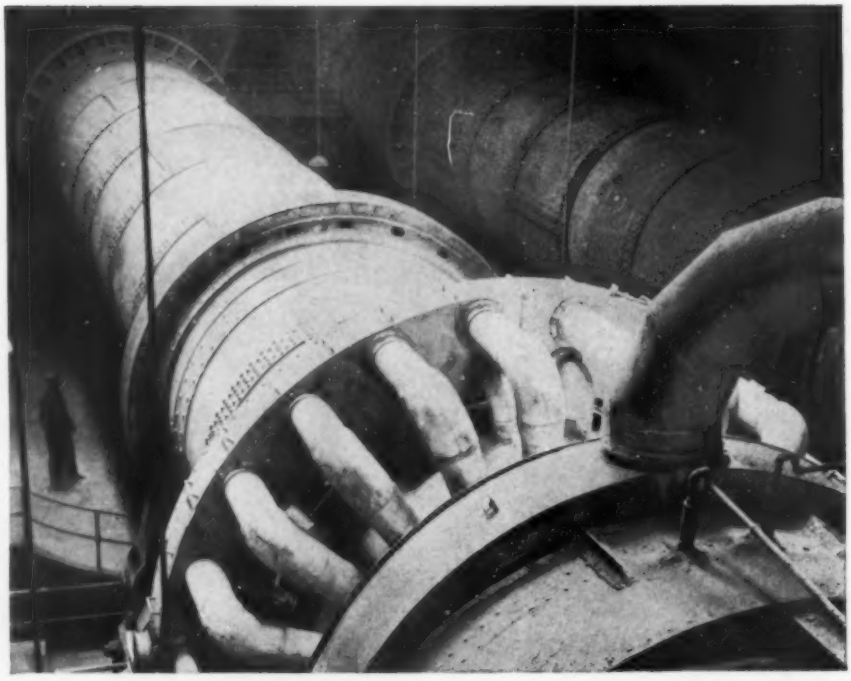
Bundy Feed Control Systems

Rotary Kilns, Coolers, Dryers

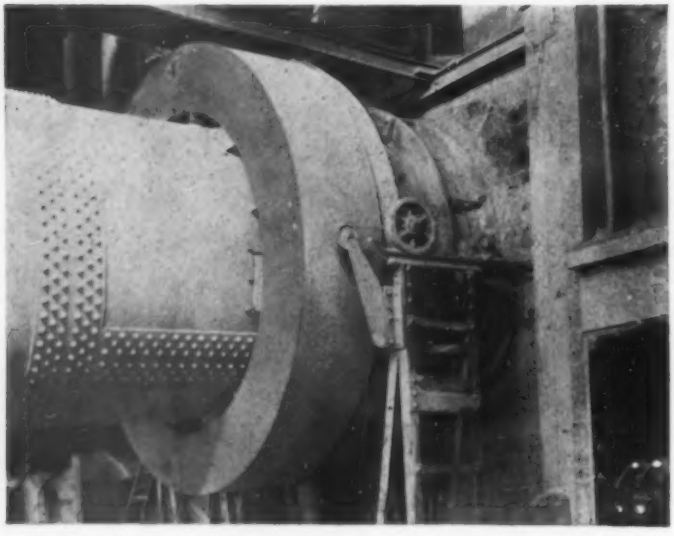
Manitowoc Speedcranes, Shovels, Draglines

Heavy Plate and Machinery Fabrication

Literature, proposal drawings and complete information will gladly be furnished on request.



VANDERWERP TYPE C1 RECUPERATOR



MINOGUE KILN FEEDER
for raw feed or dust

The Vanderwerp Recuperator is a highly efficient heat-recovery and clinker-cooling apparatus that can be installed on new or existing rotary kilns at minimum cost.

Continued demand for Vanderwerp Recuperators has resulted in bringing out our new Type F Unit, particularly adapted to plants where space is limited and where a supporting tire is positioned near or at the extreme end of the kiln shell.

WHY A STEAMER IN THE PIT?

HERE'S a place to clip off waste! Why put up with the expense of a watchman in the pit, banking fires, hauling coal and water, drawing fires and blowing down, and all the losses of time due to packing troubles, boiler tube replacement and burned grate bars to say nothing of the inefficiency of an obsolete machine?

With a Northwest gasoline, Diesel, or electric shovel, operating expenses stop when the engine stops. It brings you modern mobility. It brings you a powerful Independent Crowd and additional crowding force that other shovels waste. These are backed by the Northwest boom and no *Northwest* Welded Boom has ever failed. Add to this the Cushion Clutch, the "feather-touch" Clutch Control and other Northwest advantages and your Northwest will pay for itself in output and reduced maintenance. There is a Northwest shovel for every rock and crushed stone problem.

NORTHWEST ENGINEERING CO.
1820 Steger Bldg. 28 East Jackson Blvd.
Chicago, Illinois

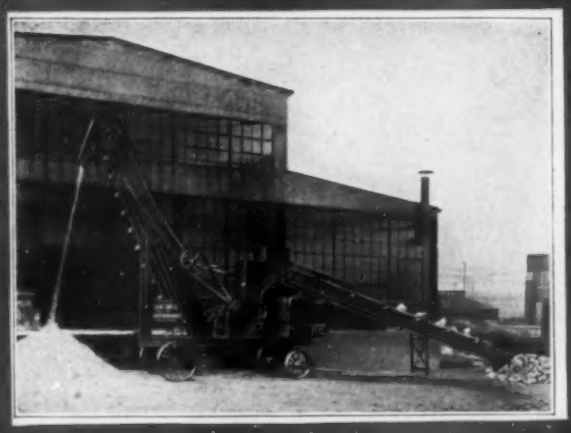
A ROCK SHOVEL from Counter-Weight to Boom Tip

GASOLINE · ELECTRIC · DIESEL · OIL

Built in a range of 18 SIZES 3/8 yd. capacity and Larger

NORTHWEST

AMERICAN



AMERICAN portable crushing plant reducing limestone to ¾" aggregate in one reduction at the rate of 300 tons per day.

WHY THE ROCK PRODUCTS INDUSTRY PREFERS AMERICAN

Their outstanding record for long life, low power requirements, minimum upkeep costs, together with the fact that they produce a more uniform product, makes AMERICAN CRUSHERS the first choice of the rock products industry.

SIMPLICITY in design and operation assures continuous service.

STURDINESS in construction enables them to stay on the job under the most severe operating conditions.

HIGHEST QUALITY PARTS guarantee absolute satisfaction in performance: SKF Spherical Roller Bearings, Cast Steel Adjustable Platen, Manganese Lined Crushing Chamber, Cast Steel Discs and Heavy Alloy Steel Shaft.

AMERICAN equipment is backed by more than 25 years' experience in designing and manufacturing reduction equipment.

● ***Send your reduction problems to our engineering department.***

AMERICAN PULVERIZER CO.

ST. LOUIS, MO.

● A new grade of "Nitramon" is now offered to quarrymen by Du Pont. The new grade is known as "Nitramon" No. 2. It has all the safety advantages of the regular "Nitramon" and is to be used in the same manner as the regular grade.

"Nitramon" No. 2 is slower than the regular grade. It is particularly adapted to soft limestone and as a top load in harder material. Its density is great enough that it will sink in water and has a strength equivalent to 40% ammonia dynamite. It will not produce headache from handling and is non-freezing.

Like the regular grade, "Nitramon" No. 2 is packed in cans. The metal containers simplify loading where large quantities are used. "Nitramon" No. 2 withstands water for an indefinite period, provided the cans remain intact. For full information, just write to: E. I. du Pont de Nemours & Co., Inc., Explosives Department, Wilmington, Delaware.

DU PONT

REG. U. S. PAT. OFF.

NITRAMON

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The Approved Blasting Agent

DEMPSTER DUMPSTER *Drop Bottom*

DETACHABLE BUCKETS *with*

No Overhang
No Sidesway
No Counterweight

BOTTOM
PRECISION
CONTROLLED
} DUMPING

LEADS THE WAY TO A NEW YEAR OF QUARRY AND CONSTRUCTION TRANSPORTATION

Zenner Bros. are among the Fleet Owners of New York City where more than 500 of these 2 cu. yd. Drop Bottom Buckets are in service daily.

Concho Sand & Gravel Co. of Oklahoma City recently installed 3 new "LF" (Load Forward) models with 15 of the 2 cu. yd. Drop Bottom Buckets.

U. S. Engineers, Conchas Dam, New Mexico, chose the Dempster-Dumpster 2 cu. yd. Drop Bottom Bucket. They have 20 Dempster-Dumpster Hoisting units on trucks handling these buckets on this project.

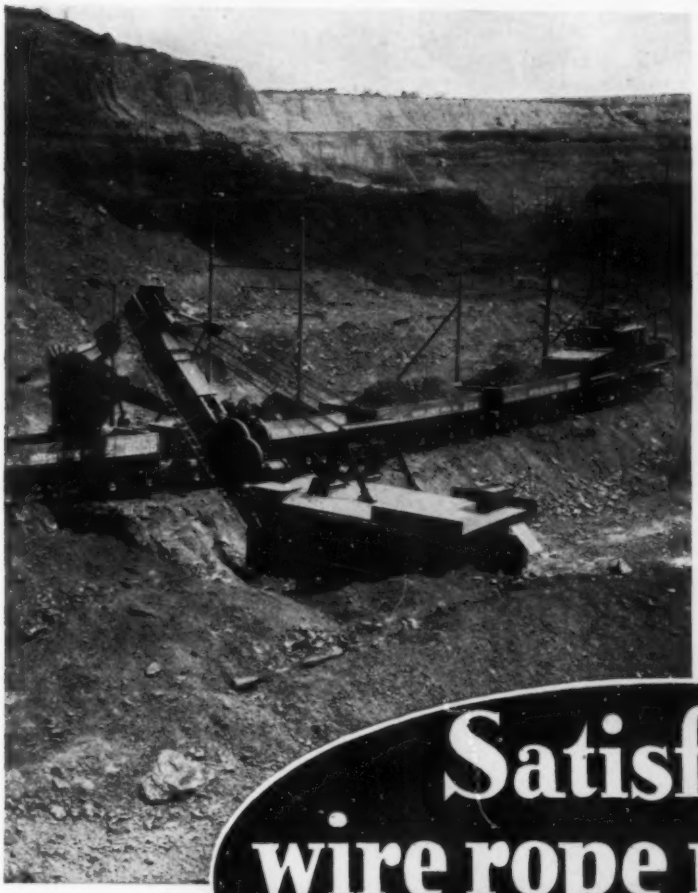
These successful operators know "what it takes" and every operator should investigate—because the new Model 200LF Dempster-Dumpster mounted on any 1½ ton truck and handling 2 cu. yd. Drop Bottom Buckets with all the load on the chassis will save 40% to 50% on any hand loading job.

Ask any user about the *DROP BOTTOM* Dumpster Bucket —then ask your Dealer or write us for details.

DEMPSTER BROTHERS, INC.
KNOXVILLE, TENNESSEE

o

WASHINGTON—BOSTON—NASHVILLE
CHICAGO—NEW YORK



Satisfy your wire rope needs with *Precisionbilt* Ropes

Other J & L Steel Products:
Standard Pipe in seamless and welded—Seamless Steel Boiler Tubes — Hot Rolled Shapes—Abrasion Resisting Plates—Bar mill products including Bars for Concrete Reinforcement—Bar size shapes —Track Spikes—Wire Nails and Spikes—Galvanized Sheet Steel Roofing and Siding—Woven Wire Fencing—Barbed Wire—Soft Annealed Wire.

Gilmore Precisionbilt Shovel Ropes are so perfectly fabricated as to completely eliminate interstices, because of the close tolerances (1/1000 of an inch) to which they are built and Pits and Quarries need the protection of such a rope more than nearly any other operation using Wire Rope.

Furthermore the variation in tension to which Wire Rope is subjected in Pits and Quarries demands a rope such as we offer. Because of its precision it has longer life and gives much better service generally—thus proving more economical to use.

We urge you to try a new Gilmore Precisionbilt Rope on your next replacement and learn first-hand of its greater value to you.

Send for our new catalog now on the press.

GILMORE WIRE ROPE DIVISION

MUNCY · PENNSYLVANIA

JONES & LAUGHLIN STEEL CORPORATION **J&L STEEL**

PITTSBURGH · PENNSYLVANIA

KOEHRING

MOVE ROCK AT LOW COST
Move rock with Koehring equipment for low cost operation. Rock digging requires rugged equipment, as well as high speed, to maintain a maximum profit schedule. Many leading contractors now accept Koehring Shovels and Dumptors as dependable profit insurance in the toughest of rock digging and hauling. Dig it and haul it with Koehring.
KOEHRING
KOEHRING
HEAVY DUTY

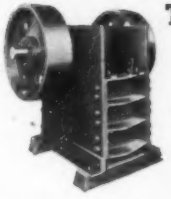
KOEHRING COMPANY

CONSTRUCTION EQUIPMENT • MILWAUKEE, WISCONSIN

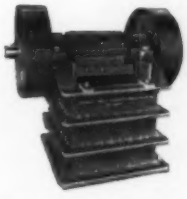
LOW COST ROCK CRUSHING FOR 54 YEARS

What are your Crushing Problems?

The GRUENDLER ORGANIZATION has your answer:

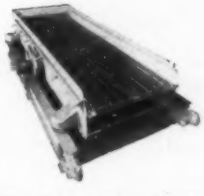


Heavy Armour Plate Steel Roller Bearing JAW CRUSHER.

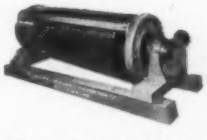


All cast steel Roller Bearing JAW CRUSHER.

Trailer Type Maintenance JAW CRUSHER with Universal Drive.



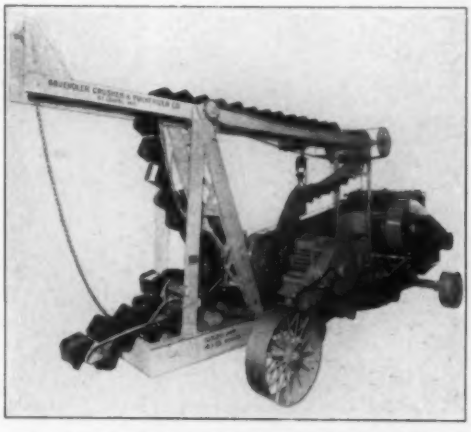
VIBRATOR SCREENS in all sizes.



Heavy Duty Revolving Screens up to 84 inch diameter

With all the skill, precision and experience gained in Manufacturing Reduction Equipment for 54 years, your particular requirements will be met considering every measure of Economy and Efficiency.

The Engineering Staff will gladly assist you in your Rock, Gravel and Sand crushing, sizing, conveying and storing problems. Plans will be furnished on any size stationary or Portable plant required. WRITE TODAY!



Designed to do an Economical Crushing job (another GRUENDLER ENGINEERING DEMONSTRATION)

A new Combination Portable Plant—Both JAW CRUSHER and ROLL CRUSHER, all mounted on one frame.

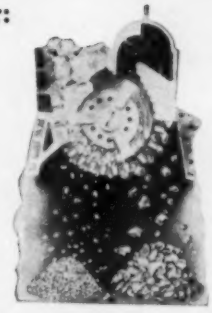
For producing finer aggregate for black top this Combination Plant performs the work economically in one compact movable unit—whereas if several stationary units were built to do identical work, it would not be as economical.

GRUENDLER

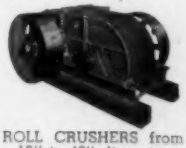
CRUSHERS · PULVERIZERS · GRINDERS

Offices in Principal Cities

Portable Crushing and Gravel Screening Plant. Capacity 60 yds. to 100 yds. per hr.



HAMMER CRUSHERS From 1 ton per hour to 500 tons per hour Capacity.



ROLL CRUSHERS from 18" to 40" diameter

Portable TWO-IN-ONE Hammer Mill for both Rock Crushing and Lime pulverizing.

Self Traveling Tractor Operated Maintenance JAW CRUSHER

Four Wheel Maintenance JAW CRUSHER with Power Unit.

Established in 1885

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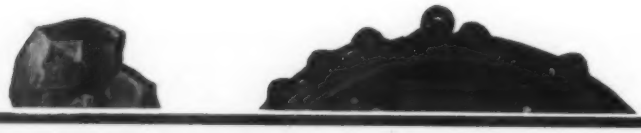
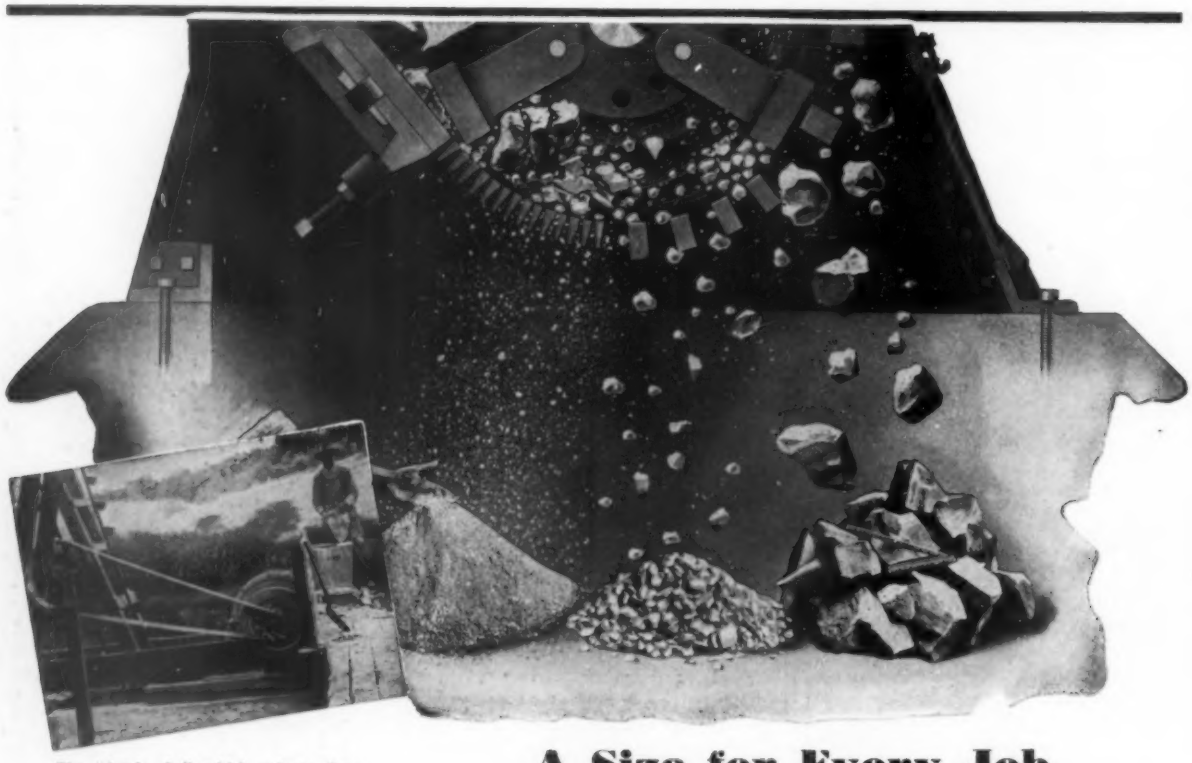
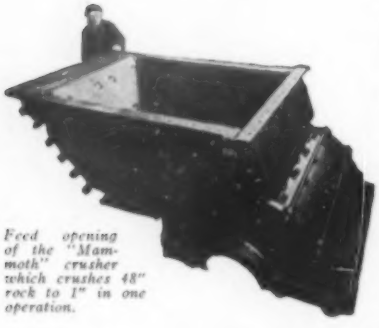


Williams Hammer Crushers

Handle Larger Rock • 50% Less Investment • Better Product



The "Jumbo Jr." which reduces "one-man" size limestone to 1", ¾" or agstone.



Feed opening of the "Mammoth" crusher which crushes 48" rock to 1" in one operation.

A Size for Every Job

The "Mammoth" crushes 48" rock to 3", 2" or 1" in one operation. Takes the place of a primary breaker and recrusher.

The "Jumbo" reduces 20" to 30" rock to 1¼" and smaller.

The "Slugger" crushes screen rejects or "one man" size rock to 1", ¾", ½" and finer.

The "NF" type is supreme as a recrusher for reducing 5" stone to 1", 1½" and agricultural limestone.

The "Non-Clog" for crushing wet muddy rock. Cannot be clogged.

FINE GRINDERS • AIR SEPARATORS • DRYER MILLS

The Williams Patent Crusher & Pulverizer Co.

800 St. Louis Ave., St. Louis, Mo.

Sales Agencies in All Principal Cities Including

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THE WILLIAMS PATENT CRUSHER & PULVERIZER CO. ST. LOUIS, MO. U.S.A. TRADE MARK

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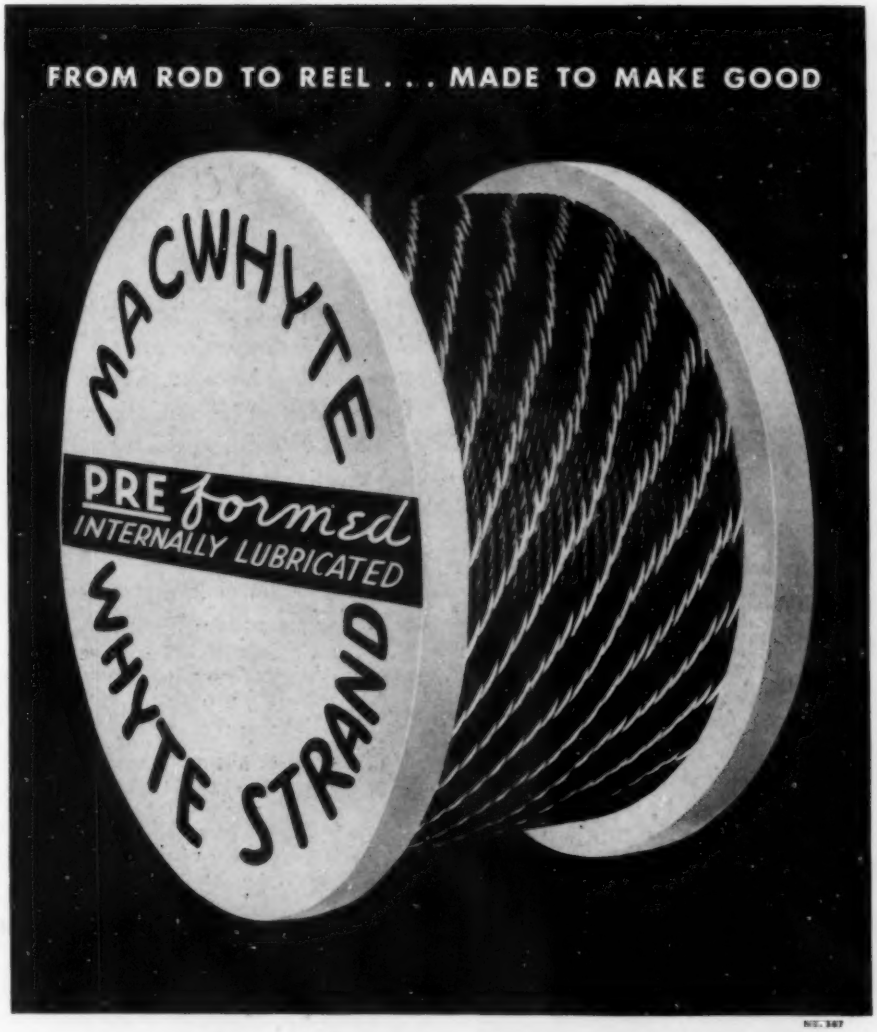
Williams

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

WILLIAMS

PATENT CRUSHERS GRINDERS SHREDDERS



LABORATORY TESTED

...which means that Macwhyte Wire Ropes, when given a "final OK" by the laboratory, are ready for dependable, economical service.

FIELD PROVED

...on all kinds of jobs, on all kinds of equipment, under all kinds of conditions. All year long, Macwhyte Engineers on the *job*, are constantly proving, improving, perfecting the *right* wire rope for *your* specific job.

MACWHYTE

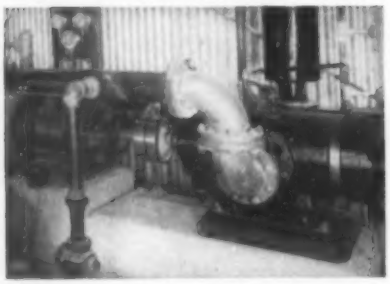
Whyte Strand · PREformed

WIRE ROPE

MACWHYTE COMPANY • KENOSHA, WISCONSIN • Manufacturers of wire rope and braided wire rope slings . . New York . . Pittsburgh . . Chicago . . Ft. Worth . . Portland . . . Seattle . . San Francisco . . (Distributors throughout the U. S. A.)

Fuller ECONOMY EQUIPMENT FOR THE CHEMICAL PROCESS INDUSTRIES

Fuller-Kinyon Pump, stationary



Fuller Rotary Compressor, Single stage

Fuller Remote-Control Unloader, unloading cement from barge

THE Fuller Company has been identified with the problems of conveying and equipment for that purpose for many years. A number of its engineers have had the advantages of designing, engineering, erecting and servicing Fuller equipment covering a span of well over twenty five years; also engineering knowledge and data passed on to them by their predecessors. The experience accumulated from contacts with many installations has led to the development of equipment peculiar to the chemical process industry. Some of this equipment is illustrated on this page.

The possibilities of savings warrants your thorough investigation of the following equipment:

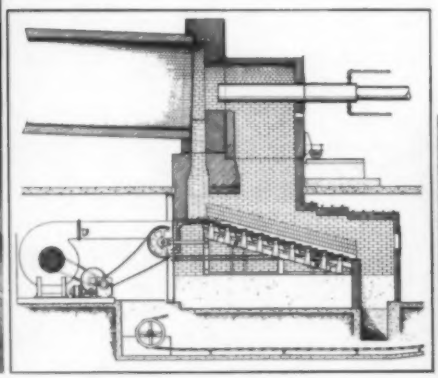
Fuller-Kinyon Conveying Systems, stationary and portable—for conveying dry pulverized materials. Capacities one to 300 tons an hour. Conveys cement as far as 3600 ft. and to elevation of 300 feet.

Fuller-Kinyon Remote-Control Unloader—for conveying dry pulverized materials from flat-bottom bins, underneath silos, cars, ships and barges.

Fuller Rotary Compressors and Vacuum Pumps, Single and Two-stage types. Capacities to 1800 c.f.m. actual free air delivery, pressures to 125-lb. gage. Vacuums to 99 percent of barometer.

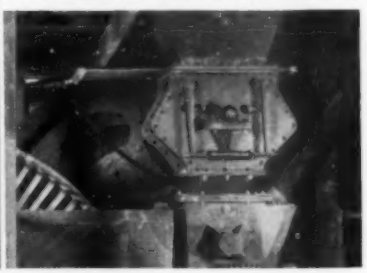
Fuller Inclined-Grate Cooler—Rapid air quenching for the production of clinker of high glass content; substantial economies in fuel consumption; unique mechanical simplicity and ease of accessibility; low maintenance costs and remarkably low power to operate. Two-stage cooling under independent control provides for maximum flexibility in heat recovery and cooling.

Fuller Rotary Feeder—for delivering raw materials, pulverized coal, cement, lime, etc. with consistent volumetric accuracy. Available in sizes to meet all normal plant requirements.



Fuller Inclined-Grate Cooler

FULLER COMPANY
CATASAUQUA, PENNA.
Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg



Fuller Rotary Feeder

G-12

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · AUTOMATIC BATCH WEIGHERS · BIN SIGNALS

The sow's ear *AND THE* V·8 ENGINE

THE proverb says that you can't make a silk purse from a sow's ear. The quality just isn't there. It's the same with trucks. No truck can turn in a record for reliable, economical service without *basic quality*.

We don't point to the Ford V-type 8-cylinder engine as the chief advantage of Ford Trucks. It's only a symbol of the extra value that a Ford gives you. The full torque-tube drive, the 47 different kinds of steel, the extremely fine tolerances to which vital parts are held—any of these points of quality or a dozen others will convince you that Ford Truck construction is *quality* construction.

The Ford Motor Company is in the truck manufacturing business—and has been for twenty-one years. A point-by-point examination of a 1939 Ford V-8 Truck or Commercial Car will convince you that there is no unit in the world of comparable size and price that is better designed and better built to serve you.

CHECK YOUR TRUCK AGAINST THESE QUALITY FORD FEATURES!

★ **V-8 ENGINES—95, 85, 60 HP.**—Smooth, dependable low-cost power. Quality materials and precision workmanship for efficient operation and long life.

★ **SEMI-CENTRIFUGAL CLUTCHES**—Non-tiring pedal action. Centrifugal force provides tremendous power-transmitting capacity. Up-keep costs kept at a minimum.

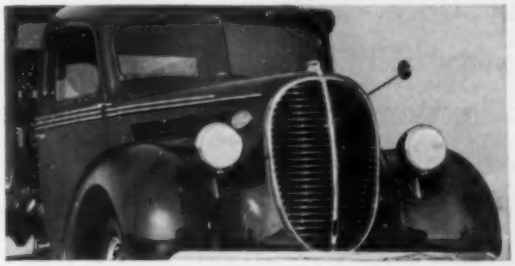
★ **STURDY, TROUBLE-FREE TRANSMISSIONS**—Large roller and ball bearings for all forward speeds reduce friction, save power. Oil-hardened chromium-steel gears for long service.

★ **FULL TORQUE-TUBE DRIVE**—Springs relieved of driving and braking stresses provide better cushioning of truck and its load. Shackle-bolt wear reduced, spring life prolonged.

★ **RUGGED REAR AXLES**—Driving pinion is straddle-mounted to maintain gear-tooth alignment. All truck axles are full-floating, with weight carried on axle housing—none on axle shafts. These features increase dependability and long service, reduce up-keep expense.

★ **BIG, POWERFUL HYDRAULIC BRAKES**—Equalized braking action for straight stops. Big brake-drum diameters and large lining areas for long brake life and low-cost maintenance.

In every detail, the quality of all Ford bodies matches the high quality of Ford chassis. Their exceptional durability means long service with low up-keep cost.



FORD V·8 TRUCKS *and Commercial Cars*

FORD MOTOR COMPANY NOW OFFERS FORD V-8 CARS AND TRUCKS, MERCURY, LINCOLN-ZEPHYR AND LINCOLN MOTOR CARS

ROCK PRODUCTS Has The Most Useful Editorial Content—*Because*

ROCK PRODUCTS Has a Staff Of Trained Engineer Editors—*So*

ROCK PRODUCTS Reaches Every Worthwhile Plant In The Industry—*And*

ROCK PRODUCTS Is The Industry's Recognized Authority—*Therefore*

ROCK PRODUCTS Advertising Produces Real Results.

5 THINGS TO REMEMBER IN 1939

Only **ROCK PRODUCTS** has these five things which are prime requisites to the success of an advertising medium.

Extravagant claims, so often used by other publications, are not necessary to prove the leadership of **ROCK PRODUCTS**. The quality of its editorial and advertising pages, the character of its readers, the enviableness of its reputation, all combine to form the most powerful advertising medium in this industry.

Advertise in **ROCK PRODUCTS** regularly for dominance of this industry's tremendous market.

ROCK PRODUCTS

205 West Wacker Drive
Chicago, Illinois

DRAGLINES *and* TRUCKS HAVE TO HUMP!

because it's a UNIVERSAL

This compact gravel plant for straight line operation is making money for its owner, an Iowa operator. It crushes, screens and loads; material passing through in a smooth, steady stream, keeping the dragline and the operator's trucks on the go all the time.

And Universals do it at the lowest operating cost and with a minimum of repairs, allowing their owners to operate at a profit on every job as Universal Crushers and Crushing Plants always do—because they've got the "guts" to stand up and grind it out even under the most constant use and even the most hard-to-crush materials.

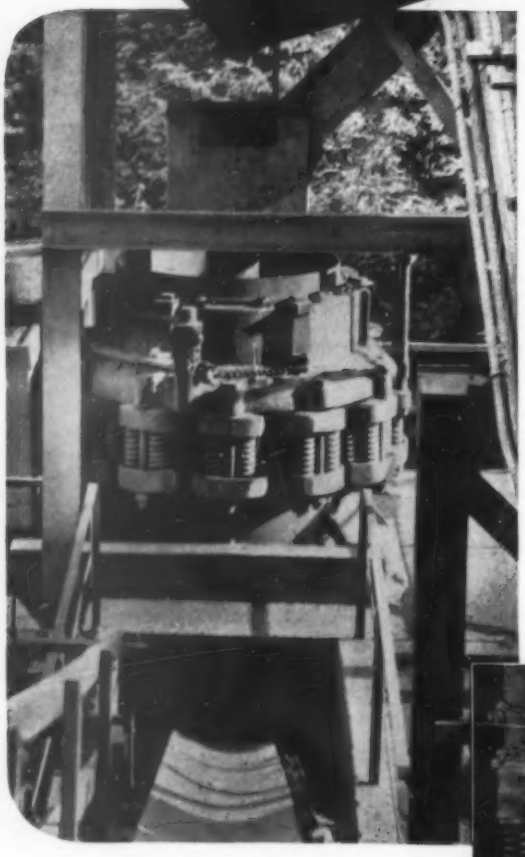
Why can Universals crush greater capacities, faster, more uniformly and at a lower cost? Superior design, improved construction, longer lasting materials that result from a third of a century of engineering experience.

Universal has built crushing equipment exclusively since 1906. Over 50 combinations of Portable, Semi-Portable and Stationary Crushing, Screening, Loading and Washing Plants are available today—each the most profitable and productive of its type in the field. You can bank on a Universal! Write for new literature.

UNIVERSAL CRUSHER COMPANY 617 C Avenue West CEDAR RAPIDS, IOWA

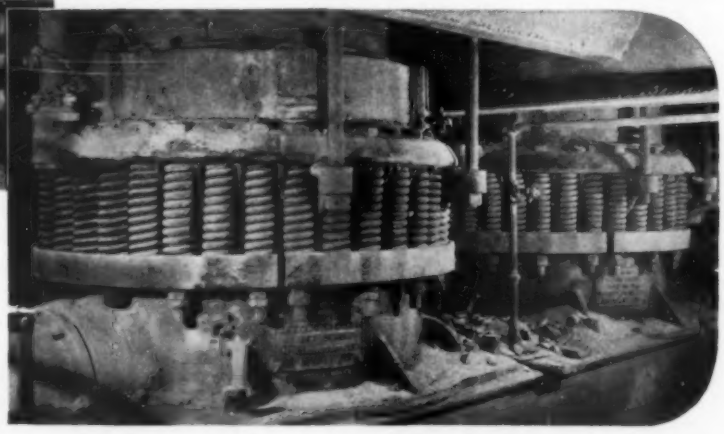
UNIVERSAL

SYMONS SHORT HEAD CONE—now supplies that finer sized stone



Here is another instance where a Symons Short Head Cone has been added to meet the changing demand for finer crushed material. The two Standard Cones were originally installed to take a 2 to 4 inch feed and make all the finer sizes then required. With an increased use of more material ranging in sizes from minus ¼ inch to minus ¾ inch, the Standard Cones are now only making the ¾ to 1½ inch sizes, while the Short Head Cone is taking the discharge from the Standards and supplying the finer products. The Short Head Cone is arranged to operate independently of the main plant, taking the surplus of any size in storage and readily producing any of the finer sizes for which there is a ready market. This combination of Symons Standard and Short Head Cones permits of greater flexibility and economy of operation and a lower crushing cost, and is the answer to meeting present day demands for the finer sizes of crushed materials.

A four-foot Short Head Cone makes the minus ¾ inch material.



Two four-foot Standard Cones do the ordinary reduction crushing.

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

NEW YORK CITY, 60 E. 42nd St. • LOS ANGELES, Subway Terminal Bldg. • TORONTO, Concourse Bldg. • LONDON, Bush House

FM-2 WAGON DRILLS

Two FM-2 Wagon Drills which are speeding up work for a New England quarry.

Faster Drilling AT Lower Cost

The flexible FM-2 wagon drill has many applications in the quarry and construction fields. The unique, light weight, sturdy construction permits the operator to handle the unit almost as easily as he can handle a Jackhamer.

Below are listed six reasons why the FM-2 will interest you. For more details send for bulletin No. 2253-A.

The I-R line includes hundreds of other sizes and types of drills, Jackbits, Sharpeners, and Drill Steel, 1000 compressors, 300 hoists as well as pumps, engines and pneumatic tools of all kinds.

673-5

The FM-2 Wagon Drill

Six Reasons why the FM-2 Will Interest You.

1. It is flexible in operation. It can drill holes at any angle and can be quickly and easily moved over rough ground from one location to another.
2. An air-motor feed is entirely positive in all directions. It will exert a feed pressure from 0 to 1000 pounds. Hand cranking and hand holding is entirely eliminated.
3. A self-locking worm gear eliminates all thrust and shock from the air motor, keeps the drill in position and regulates the motion of the drill when it hits a soft spot or when a steel breaks.
4. Set-up time is reduced. Time spent in changing steels is cut in half. One man can easily raise or lower the drill tower on the frame by means of a ratchet lever.
5. It permits the use of large, high powered drills which will handle larger and deeper holes in even the hardest rock.
6. Twenty-four foot steels are easily handled. Standard units accomodate six foot steel changes. It's one-piece tubular frame combines light weight with rigidity.

Atlanta
Birmingham
Boston
Buffalo
Butte
Chicago
Cincinnati
Cleveland
Dallas
Denver
Detroit
Duluth
El Paso
Hartford
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Newark
New York
Philadelphia
Pitcher
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Salt Lake City
San Francisco
Scranton
Seattle
St. Louis
Tulsa
Washington

Ingersoll-Rand

11 BROADWAY NEW YORK, N. Y.

To The Industry's Equipment Manufacturers

WHAT OF 1939?

THE earnings of the rock products industry are increasing. More money is available for modernization. More money will be spent.

Constantly increasing volumes of construction work indicate that still greater increases are in the making. Our industry has already spent huge sums for rebuilding its own plants.

Yet the needs are so great and the requirements so rigid that plant operators everywhere are confronted with the problem of selection.

Are you making sure that your equipment will be on their lists?

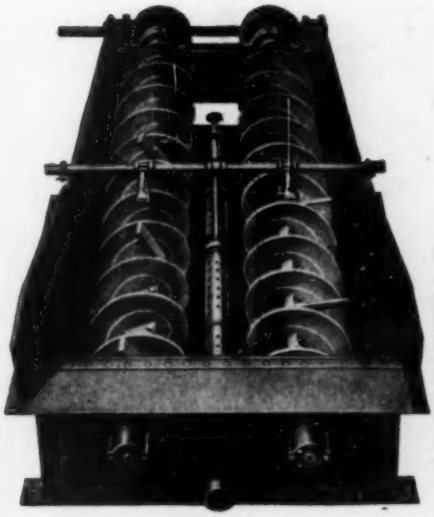
Are you keeping the story of your equipment and of its many advantages before these men month after month through the magazine to which they look for leadership?

Rock Products

205 West Wacker Drive
Chicago, Illinois

HOW TO MAKE MORE PROFIT *in* 1939

The first requirement is to make certain that your aggregates can meet the most difficult specification requirements. From our complete line of aggregate washing equipment, developed to the highest degree of efficiency, you will find the size and type best fitted for your needs.



EAGLE SPIRAL SCREW WASHER

This DOUBLE SPIRAL SCREW WASHER is specifically designed to thoroughly scrub the aggregate—removing all mud, sticks, leaves, silt, coal, shale and clay balls, and deliver a finished product of the finest quality.

Twin screws throw the aggregate to the center of the machine and convey it the length of the tub over the inlets where water rushes up through the material, cleaning it thoroughly and conveying all foreign matter to the surface and over the lower end of the overflow where it is flumed away.

One operator, by using an 18-inch EAGLE Twin Screw Washer, was able to reduce the shale content of the aggregates, which was relatively high, to 0.8% by weight, under the limit allowed by the Iowa State Highway Department.

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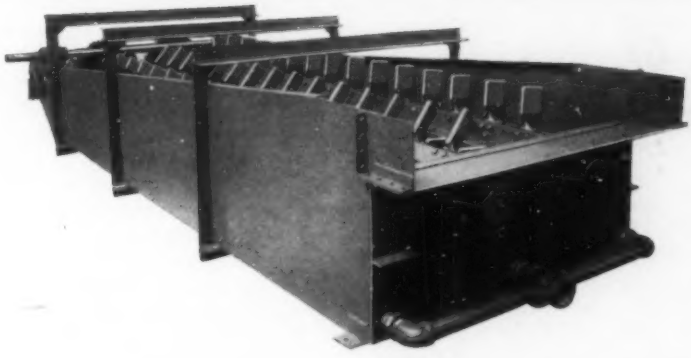

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ROCK PRODUCTS

New Practices, Products, Problems

The primary obligation of ROCK PRODUCTS editors to their readers is to keep them posted on the latest developments and trends. To meet that obligation, the editors all started with engineering educations and experience, for the production and manufacture of rock products involves technical processes in nearly all branches of engineering. Jointly the editors yearly travel enough miles to go two and three times around the world; and jointly the editors owe much to ROCK PRODUCTS' friends all over the country, whom they visit in the course of these travels, for most of the information contained in this and every issue of ROCK PRODUCTS. To them and to all our readers, advertisers and friends, the editors extend their best wishes for a happy and prosperous new year—and their heart-felt gratitude for many favors and courtesies received.

We are very happy to be able to report that all the prognosticators predict a year of comparative prosperity, as good anyway as 1936, with particular emphasis on the construction industry. It is even predicted that the New Deal's zeal for business and economic reforms (often erroneously so-called) will be tempered by better judgment, based on experience and the chastening effect of a more independent Congress of Representatives of a Free People, who have given unmistakable proof that they would like to retain a little freedom. Moreover, men of business and industry are showing more evidence of adjustment (or reconciliation) to political and economic conditions which have been continuously disturbing for the past five or six years. All in all, we can say with confidence, it looks like a good year.

So that our readers may begin to make preparations for the business in store for them, the editors have critically examined the data gained in their contacts with the industry during the past year, and have picked out methods, processes and equipment which seem to represent the best practice, or the practices toward which the industry is tending. If our readers will carefully read the articles in this issue they will get inspiration for many cost-saving ideas—often simple changes, such as more efficient feeders, rearrangement of equipment, changes in flowsheets, rebuilding old equipment, etc.

Producers who have failed to take advantage of such economies will be hard pressed not merely to meet production demand, but demands for improved products, because users of rock products have also taken advantage of hard times and stiff competition to become more exacting in specifications for quality. As an example, we no longer have merely standard portland cement, but five or six varieties, which must all be made in the same equipment. We have demands not merely for "crusher sand", or crushed-stone screenings, but demands for carefully graded "stone sand" of *rounded* grains, not *sharp* fragments. We have demands for fine aggregates of very specific fineness modulus, not merely "concrete sand". We have demands for coarse aggregates that will be free from "stripping" when used in bituminous type pavements.

In the field of labor relations, producers face competition under new and strange conditions. Some must adhere to the Walsh-Healey Act in filling orders for government construction; some come under the Wages and Hours Act; and some don't. Both these federal laws have a much greater practical effect on labor costs than many producers yet realize. It is generally not only a case of increasing the minimum wage but of raising all wages, because it is usually necessary to maintain existing wage differentials between various kinds of labor.

Drafting of union labor contracts and working under them will require the very best efforts of executives in our industry. In solving these problems an operator would be wise to seek the advice and coöperation of others in the same and allied industries and of the national associations of his industry. If he is not a large enough operator to employ a labor relations expert, whole or part time, he should endeavor to make himself one. The most essential thing a labor relations expert must have, and he can't learn it in college or from his friends or associates in an industry, is an innate sense of fairness, justice and honor. These qualities will win respect and loyalty among employes as they would in any other part of society.

In the field of public relations rock products producers are doubtless ready to take their places in community and association activities looking toward a better understanding of industry on the part of their employes, their neighbors, their customers, and possibly themselves. The most effective beginning of a public relations campaign is to make one's own plant neater, safer and more attractive to employes. Maybe this means installation of dust-collecting equipment, the construction of a bath house and decent sanitary facilities, or maybe only the use of a little paint. No item that gives a bad impression to employes or public is too small to be considered; and in actual results, more effective than "educational propaganda."

Nathan C. Rockwood

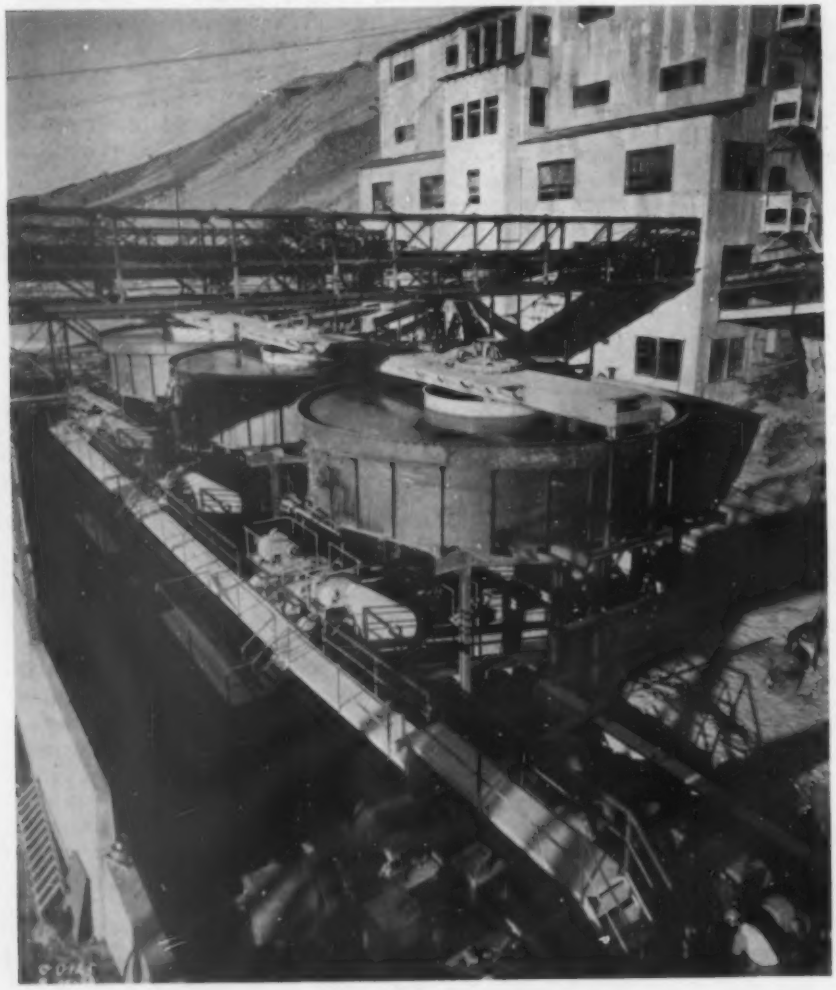
Make Three Sand Sizes For Blending

By ANTHONY ANABLE*

Grand Coulee Dam, 90 miles west of Spokane, Wash., is probably the largest thing planned or constructed by man. Its length at the crest is to be 4300 ft., its height above bed rock 550 ft., and its thickness 500 ft. at the base, tapering to 30 feet. at the top. This great wall will require 12,000,000 cu. yd. of concrete, three times Boulder Dam.

Here, as previously at Boulder Dam, the matter of preparing a closely graded aggregate is regarded by the authorities as the most important single element affecting the physical characteristics of the concrete. The sand preparation plants at Boulder and Grand Coulee are remarkable, not so much because of the sheer magnitude of their operations, as because of the delicacy of the control and the ease with which they produce continuously and almost automatically an aggregate having precisely the fineness modulus specified.

The equipment used and the methods employed trace their lineage to the fields of hydro-metallurgy and ore dressing, where continuous operation and close control of fineness have always been essential to low-cost operations and uniformly high extractions of metal. To date those methods have been applied only in the rock products industries at large plants. However, with the increasing attention that is being given to fineness control throughout the industry, it is highly probable that the lessons learned at the Grand Coulee preparation plant will soon be widely applied successfully and economically.



Three Dorr "Hydroseparators," below which are three Dorr classifiers, for sizing and dewatering the undersize from the last gravel screens

Two Grand Coulee Dams and Their Builders

There are, in fact, two Grand Coulee Dams and two aggregate plants, although this article will deal only with sand preparations at the second. The foundation dam, or Low Dam as frequently called, was completed by the contracting firm of Mason-Walsh-Atkinson-Kier on March 15, 1938. On that day, Consolidated Builders, a combination of M.W.A.K. and the Utah Construction Co., Morrison Knudsen Co., Inc., MacDonald and Kahn Co., Ltd., Pacific Bridge Co., General Construction Co., J. F. Shea Co., Inc., Henry J. Kaiser Co., and The Kaiser Co. took over under contract the building of the upper portion of the dam, known as the High Dam. Previously, the Henry J. Kaiser Co. had been one of the Six Companies, Inc., builders of Boulder Dam, and of the group known as Columbia Construction Co., builders of Bonneville Dam.

New Sand Plant

A certain amount of the sand equipment used on the Low Dam project was used for the High Dam. This included three Dorr "Bowl" classifiers and three Dorr "Torq" thickeners.

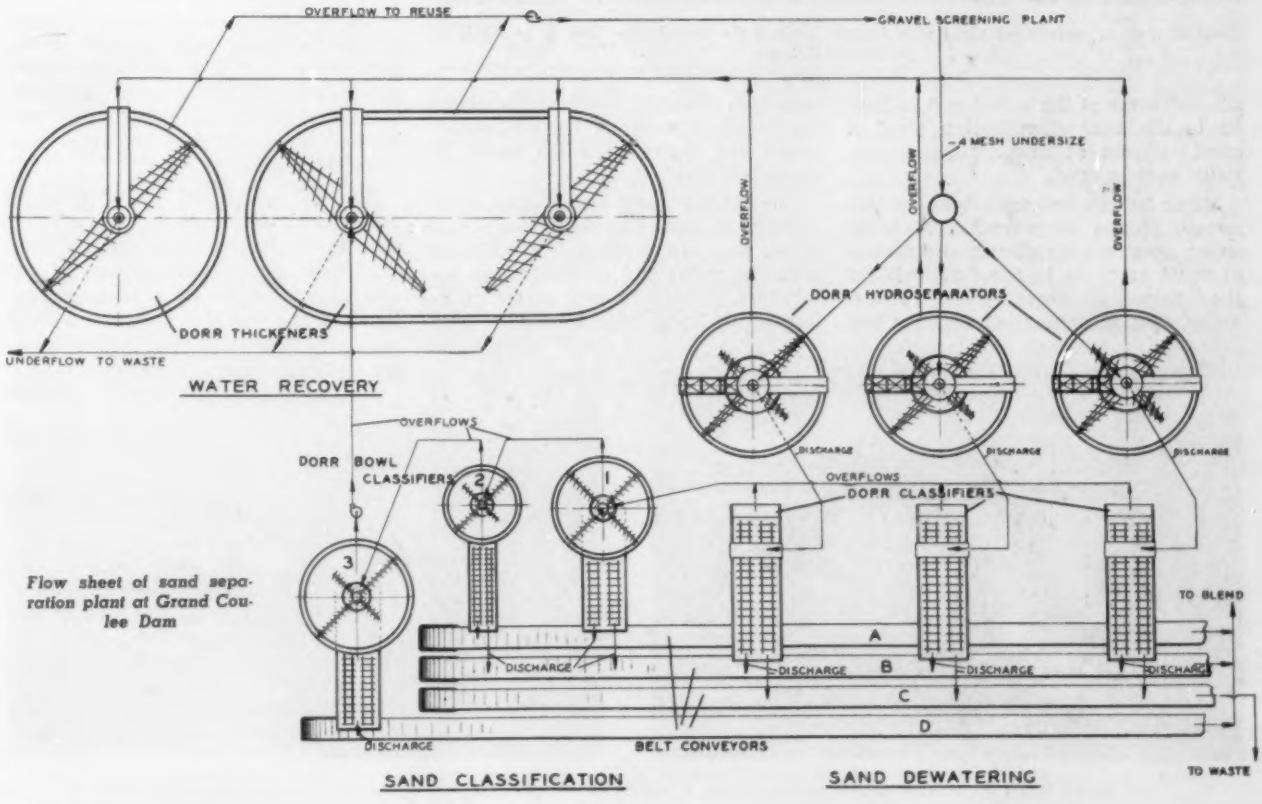
In addition to these still serviceable units there were purchased for the new and enlarged sand plant preliminary dewatering equipment, consisting of three Dorr "Hydroseparators" and three heavy-duty Dorr FX classifiers. A flowsheet of the new and enlarged sand plant appears in this article, showing diagrammatically the three major steps or operations—first, sand dewatering; second, sand classification; and third, water recovery.

Sand Dewatering

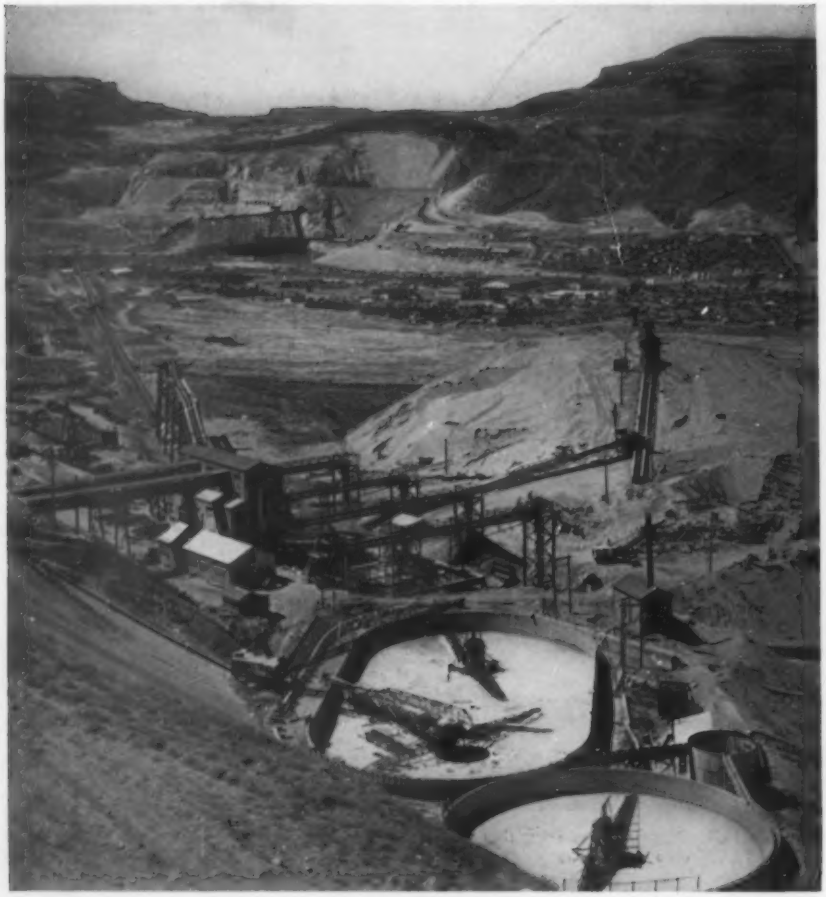
Following the production of four grades of gravel, the minus ¼-in. undersize from the last screen and the bulk of the wash water used in the preparation of gravel flows to the sand dewatering plant. This consists of the three Hydroseparators, each 35 ft. in diameter by 9 ft. deep, followed by the three heavy-duty classifiers, each 14 ft. wide by 30 ft. long. The purpose of these is to remove excess water and fine clay,

*Dorr Co., Inc., New York City.

On the right can be seen the discharge from two Dorr Bowl Classifiers and, in rear, that from three Dorr Hydroseparators dropping via chutes onto sand belts



Flow sheet of sand separation plant at Grand Coulee Dam



General view of aggregates plant from hillside beyond the pit—Coulee Dam is in left background in distance

silt and slime at the outset and to pass on to the sand classification plant a steady stream of dewatered and partially washed sand.

Minus 4-mesh undersize from the last screen, plus a large excess of wash water, goes to a distributor and thence in equal amounts to the feed wells of the three Hydroseparators. Excess water, containing most of the clay and superfine, overflows continuously across the peripheral weirs of the Hydroseparators and passes on to the water reclamation plant.

The coarser sand constituents settle rapidly in the Hydroseparator tanks where they are swept to the center by revolving rakes and discharged at low moisture content through a centrally-located discharge cone. Hydraulic water is introduced at four points in each cone to remove the last traces of superfines before discharge.

The now drained and partly washed sand discharged by the Hydroseparators drops to the three classifiers directly below. These make a coarse separation, ranging between 10 and 28 mesh. The finer or overflow portion goes to the three Bowl classifiers for further separation into fine fractions. The coarser or discharge product is diverted to a pair of belt conveyors, one of which, C, discharges to waste and the other, B, to the sand blending plant. The split between these two belts, B and C, may be at any desired point and is dependent upon the amount of the coarse sand that is needed for the final blend —a fineness modulus of 2.90, plus or minus permissible tolerances of 0.20.

Sand Classification

The overflow from the three classifiers in the sand dewatering plant passes in sequence through the three Bowl classifiers with bowl diameters of 16 ft., 13 ft., and 25 ft., respectively. The sand fractions discharged from Nos. 1, 2 and 3 Bowl classifiers are split between three conveyor belts, leading to the sand blending plant or to waste. These three sand fractions plus a portion of fractions from the classifiers in the dewatering plant make up the final blend.

Water Recovery

The water recovery system consists of an oval tank with axes of 125 ft. and 250 ft. and a round tank, 125 ft. in diameter. Deposited solids are swept to the center and discharged from the bottoms by three 125-ft. diameter Dorr Torq thickeners.

All wash water, not carried away as moisture in the recovered and rejected sand fractions, eventually reaches these thickeners. Feed, thus, consists of the overflows from the three Hydroseparators and the overflow from No. 3 Bowl

Left: To the left is the washed gravel storage. Right: A portion of the conveyor belt system for handling gravel to storage

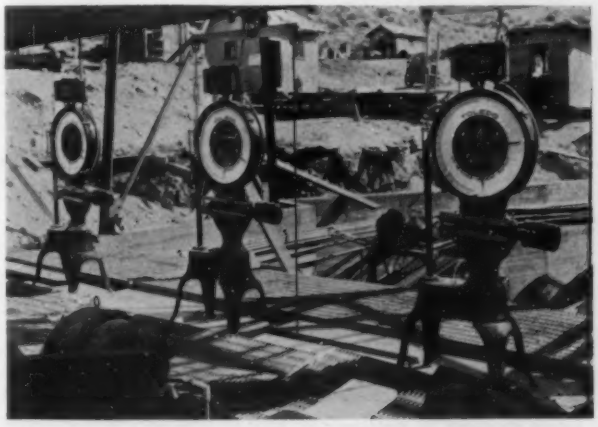
classifier, the largest and last bowl in the series of three. Feed enters centrally through semi-submerged loading wells. Clarified overflow is taken off across continuous weirs extending around the complete peripheries of both tanks. Suspended solids settle to the bottom as a heavy sludge and are swept by the thickener mechanisms to discharge ports at the center.

The clear overflow is collected in a sump and pumped back to the gravel plant where it is used over again on the screens. This practice reduces make-up water to the equivalent of the wasteage with the sand and sludge plus an allowance for evaporation and leakage. The solids are discharged from the bottoms of the tanks and sluiced to waste.

Operating Data

The requirements which had to be met at this sand preparation plant were a feed of 2200 tons per hour of minus 4-mesh sand and an output of 750 tons per hour of a finished blended sand that would meet a government specification calling for an average fineness modulus of 2.90, with a maximum of 3.10 and a minimum of 2.70. Design was based on the weighted average composition of raw aggregates in Brett pit, but flexibility was provided throughout to take care of possible future variations.

Operation was established in August, 1938, a few weeks after the start of the plant, at a feed rate of 2200 tons per hour, which yielded a finished blended sand amounting to 750 tons per hour, on a dry basis. Fineness modulus ranged from 2.75 to 2.85. Of the blend 67 percent consisted of coarse sand from the three heavy-duty classifiers in the sand dewatering plant and 33 percent consisted of all the finer sand fractions discharged from Bowl classifiers Nos. 1 and 2. At that time the fine sand from the No. 3 Bowl classifier was being sent to waste and not to the blending plant.



Toledo Chronofio scales which control the openings of chute hoppers into which classified sand is deposited

Other Changes at Coulee Dam

By NATHAN C. ROCKWOOD

The reader is referred to ROCK PRODUCTS, March, 1936, for a very thorough and comprehensive description of the original aggregates plant, by Edmund Shaw, contributing editor of ROCK PRODUCTS and an authority on sand production problems.

The pit material is scalped on a stationary grizzley (new) which rejects everything over 10 in. These rejects go to a 56-in. x 72-in. Buchanan jaw crusher (new). The scalped material and the crushed material go to a 60-in. belt conveyor into a stock pile over the original raw storage feeder galleries.

The material from this raw stock pile is reclaimed by means of Conveyor A, fed by two vibrating feeders (original Jeffrey). Conveyor A,, 60-in. wide, takes all of the material into the crusher house, deposits it in either or both Allis-Chalmers 6 ft. x 22 ft. trommel screens (original). All of the material minus 60 in. passes through the trommel screens. Material over 6 in. is crushed in either of two gyratory crushers (original Telsmith). The crushed material and the material below 6-in. passing through the trommel screens is deposited upon Conveyor B, 60 in. wide, from which it is dumped in a balancing stock pile, over a feeder gallery from which point it is withdrawn by either of two 42-in. conveyors (Conveyors C and D).

The material so withdrawn by these belt conveyors, all minus 6-in., goes into the top of the screening plant. The material from each conveyor is delivered to separate batteries of two Allis-Chalmers vibrating screens each (new) with a 3-in. top deck, and a 1½-in. bottom deck. The two screens reject finished 3-in. x 6-in. and finished 1½-in. x 3-in. These two sizes of materials, by means of chutes and rock ladders, are deposited respectively on two conveyor belts, from which point they go into finished storage. The material passing through the Allis-Chalmers screens (minus 1½-in. material) goes to four Tyrox vibrating screens (new), 5 ft. x 10 ft. in size, the top deck of which is ¾ in., and the bottom deck ⅜-in., 5/16-in., ¼-in., 3/16-in. or No. 4.

The top deck of the screens rejects finished ¾ in. x 1½ in., and the bottom deck rejects No. 4 x ¾ in. These two sizes of material are deposited upon the conveyor belts and go respectively to two finished storage piles. The material passing through the bottom deck of these screens, together with the wash water, flows in launders to the Hydroseparators, where the sand classification begins, as described by Mr. Anable.

The three sizes of sand classified are deposited upon three separate conveyors. These conveyors dump material into chute hoppers, the openings of which are controlled by three Toledo Chronofio scales.

The scales make it possible to maintain a predetermined percentage of materials on each belt, and by controlling the opening of the material flowing on the belt, forces the excess material through the back end of the chute on to a conveyor going to the waste pile on the river side of the plant.

The three sizes of finished sand, which are permitted to flow from the chute hopper by means of the scale controlled gates, are combined on a single 36-in. conveyor, by which it is transported to a finished sand stock pile over the main tunnel. There is approximately 105,000 cu. yd. of sand.

The sand is deposited in either of three piles, by means of the airplane tripper, which moves back and forth continually while the sand is being deposited in the piles. This insures that the sand will be thoroughly mixed when it is reclaimed. Approximately 18,000 cu. yd. of sand can be drawn to the main conveyor from each of these three piles. In the original plant the sand was stored in separate sizes.

This storage system gives an opportunity for the free water to be drained from the sand before it is necessary to recover the sand. Under the stock pile of sand is a system of tunnels and drains to carry away the excess water.

To carry the aggregates from the producing plant to the concrete mixing plant, a distance of nearly a mile, is a 60-in. Goodyear conveyor 8-ply belt, said to be the world's largest. The belt travels on roller-bearing idlers at 450 ft. per min., providing 2000 tons per hr.

Demands for New Products Require Plant Changes

By BROR NORDBERG

With the development of new markets for their products and frequently changing and new specifications, producers of crushed stone and sand and gravel have been re-arranging their plants. Some of the work done has been large-scale modernization, while in other cases additional crushing and screening equipment has provided the necessary flexibility.

A large producer in Pennsylvania who recently reconstructed his plant to enable him better to keep pace with the times, tells us that his plant is equipped to produce 13 sizes of stone from ballast down to the smaller grades, either washed or unwashed. A few years ago four or five sizes would have served the purpose.

This statement serves as an example of an obvious trend taking place in the industry. This producer could well boost his stock in trade to 20 or more sizes of material if he decided to produce agricultural stone, stone sand and some of the "dusts" or fillers being produced by others. His plant has been redesigned with proper crushing equipment, adequate screen cloth surface, and flexible chute arrangements to enable the production of all these sizes of material without changes in the settings of crushers. Recently added products are in the finer classifications.

Many plants have been rebuilt, not merely to increase capacity, but in order to produce an equal tonnage in smaller sizes. This requires the use of more reduction crushers and necessarily increases the per ton costs.

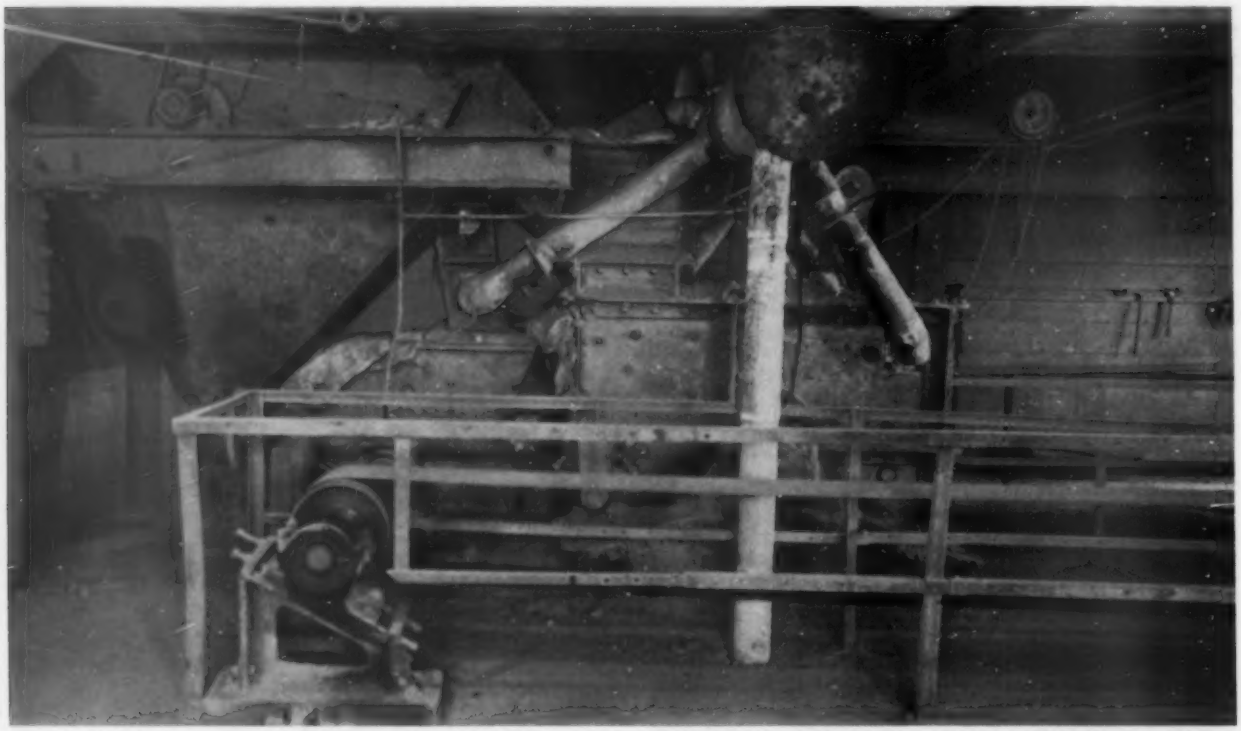
Gyratory and jaw crushers, of course, predominate as primary breakers and the choice is determined by the capacity desired and the size of the feed as taken from the quarry. In ordinary large and medium capacity commercial stone plants, the cone crusher and the gyratory crusher are effectively used for reduction where large capacity is desired. Two or three of these units, with setting to produce varying product sizes, give the needed flexibility.

Undoubtedly the most noticeable trend of reduction in stone plants, for small tonnages, and in sand and gravel plants generally, is the use of crushing rolls. Production with this type of equipment, when properly used, is comparatively large at a low consumption of power. Producers have yet to learn much in regard to the limitations of this machine in order to utilize best its advantages, which are low cost, low upkeep, low head room and a wide range of utility.

Sand and gravel producers have installed rolls, smooth-faced and corrugated, to make sand from gravel, for reduction of gravel to smaller sizes, to crush pea gravel into sand which otherwise would be wasted, and for recrushing sand into finer sand.

New Development in Crushing Rolls

The Hartland-Verona Gravel Co., Verona, Wis., operator of a modern plant, has developed a new type of rolls that apparently has much merit. Details of this crusher, which has been patented, are reproduced in full to



Arrangement of hammer mills at a portland cement plant with a vibrating screen overhead to distribute the load proportionate to capacities. Oversize is crushed through the mill on the right; the machine on the left handles intermediate sizes and the screen throughs by-pass both mills, the three products joining on a common belt conveyor

Installation of Link-Belt "Rotoscoop" on ladder dredge to produce masons' sand. The feed is minus ⅛-in. material from an overhead revolving screen and the overflow from the concrete sand cone to the left

illustrate some of the new features possible in a very old type of crusher.

These rolls have been in operation for two seasons and, according to performance records, have reduced abrasion on the manganese steel facing considerably. It will be noticed from the drawing details that two almost parallel crushing faces approach each other at the point of nip, which is said to avoid most of the abrasion that would occur in rounded shells when hard, smooth stone particles slip at the point of nip and "ride the rolls." Increased capacity is also claimed for the machine and it is apparent that larger than ordinary ratios of reduction are possible. The wearing surfaces are a series of parallel segments so bolted to the inner shell that any one may be replaced.

A jaw crusher of unusual design to combine primary and secondary crushing in a single pass has been developed by Straub Manufacturing Co., Oakland, Calif. The crushing mechanism of this machine, designated the "Kue-Ken balanced crusher", is an entirely new principle, the main feature being two long, opposed balanced pendulum jaws which have an action designed to eliminate abrasion and vibration. The accompanying diagram best illustrates the short travel and swing of the jaws toward each other. It will be noticed that rocks will be instantly gripped, crushed and released.

The upper ends of the jaws travel a shorter distance than the lower ends to impart maximum leverage on the largest rock and the longest jaw travel on the larger volume of smaller rock at the lower end.

The crushing mechanism, in the sealed, all-steel, dust-proof housing, consists of a steel shaft and two outer compression pitmans with one inner tension pitman in between them. The outer pitmans push down while the center one pulls up—contributing to balanced weights and speeds which are said to cut out vibrations and stresses. Oil flooded, balanced toggles are arranged to give rapid approach at the start of the jaw travel followed by a slowing down to crush the hardest rock. Flywheels are not needed and leverages five times as great as those of conventional motions are claimed.

This crusher requires relatively low headroom and has a feed opening that can receive coarse or fine feed from any angle. Other features are moving cheek plates to accelerate the passage of material to the crushing zone, a method of holding jaw plates in place to permit wear down to a minimum size, and a readily accessible adjustment device for quick changeover from one product size to another.

Standard sizes range from those which will receive 5- x 10-in. rock to others which will take 16- x 48-in. rock. It is claimed that high ratios of production are being obtained with a good percentage of fines.

Traylor Engineering and Manufacturing Co., Allentown, Penn., pioneer in all steel, welded equipment, has enlarged the line of TY gyrating reduction crushers to have a range of from a few tons of sand per hour to hundreds of tons reduced to about 2-in. The Traylor type H Blake Jaw Crusher has curved, smooth face jaw plates that utilize the principle of the "bell head and curved concaves" of the TY crusher.

Agricultural Stone

The Hercules type of mill, a three-roll machine, which is practically a duplicate of the larger Bradley Hercules mill used extensively in portland cement mills for preliminary crushing of raw material and clinker, has been installed in a number of stone plants in 1938 to produce agricultural stone.

One of the illustrations shows a Bradley, Jr., mill in operation at one of the plants of the New Castle Lime and Stone Co. in Pennsylvania. At this plant the feed (screenings) is dried first to contain less than one percent moisture. The mill discharges through a wire screen cloth, which is replaceable, to control the fineness of the product. Feeds of ¾- to 1-in. material are reduced to agstone sizes in a single pass. The feed is regulated by adjustable feed tables, which in turn are fed from bins.

Stone sand has proved to be a valuable by-product that is gaining greater acceptance. Several concerns began to manufacture the product in 1938 and others are considering it, particularly in remote localities where there is little competition from natural sand.

Fig. 1.

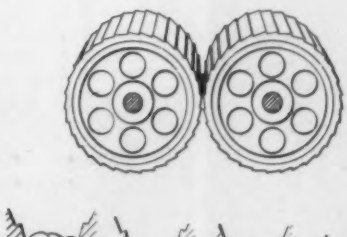


Fig. 2.

Fig. 4.

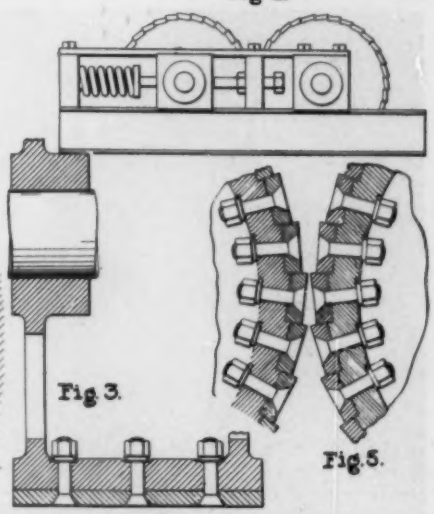
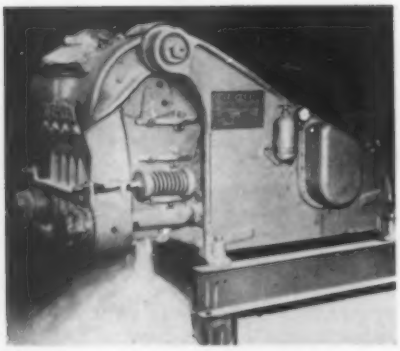


Fig. 3.

Fig. 5.

Details of new rolls developed by Hartland-Verona Gravel Co., Verona, Wis., to reduce slippage at the point of nip—the cause of abrasion and excessive wear. The wearing surfaces are bolted to the main shell as shown and individual segments are replaceable



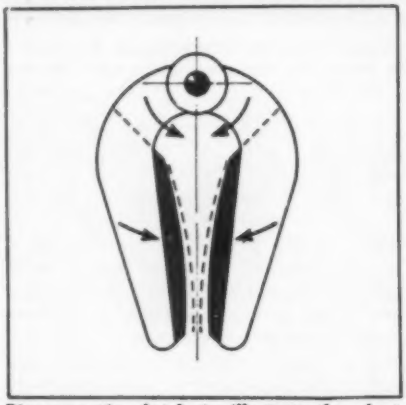
New type jaw crusher developed by Straub Manufacturing Co. to perform primary and secondary reductions in one operation

The recombining and blending of fines produced through various crushers into a graded product is the usual procedure where markets are desired for excess screenings. Consensus of opinion is that a cubical product is desired to get desired properties in concrete, such as the product produced by a rod mill or ring roll mill. A Gruendler ring hammer crusher is used for that purpose by Dolese and Shepard Co., La Grange, Ill., with limestone dust as a by-product.

Government engineers still adhere to the conventional hammer mill for large scale production of stone sand, despite opinions that the product is apt to be too slivery. At Hiwassee dam, near Murphy, N. C., the same hammer mills used in the earlier Norris dam aggregate plant are producing stone sand from a highly siliceous rock containing 65 percent quartz. Blending and gradation facilities, however, are more highly developed than would be possible in smaller scale operations, and serve to overcome many of the shortcomings due to angular and slivery shape of particle.

The use of hammer mills for reduction of stone in cement mill crushing plants isn't new but one of the illustrations shows a novel arrangement used in an interesting plant. Two hammer mills and a vibrating screen are used, partly because each mill by itself had insufficient capacity.

A 1½-in. primary crusher product is put over a Link-Belt, double-deck vibrating screen, placed directly over a 24- x 48-in. Pennsylvania hammer mill and a 30- x 36-in. Jeffrey hammer mill. Plus 1½-in. stone is put through the larger mill, ¾- to 1½-in. stone through the other, and the throughs join the products from the mills on a common belt conveyor. The load is distributed with about 50 percent through the large



Diagrammatic sketch to illustrate the short travel and swing action of the "Kue-Kin" crushing jaws

mill, 12½ percent through the small capacity mill and 37½ percent bypasses.

Screening

Mechanically vibrated screens are now practically standard practice in aggregate production, but a trend continues toward more of the horizontal, low-head room type. The use of electrically vibrated screens has increased, especially paralleling the need for more preliminary grinding in closed circuit in portland cement mills. The application is for the grinding of slurry as well as dry material. On this type of work the screens make separations at about 20-mesh, for which they are particularly well fitted. Revolving screens, without or in combination with a revolving scrubber, and mechanically vibrated screens are used alike for scalping purposes, with the former in favor where the deposit is contaminated with clay balls and other objectionable matter.

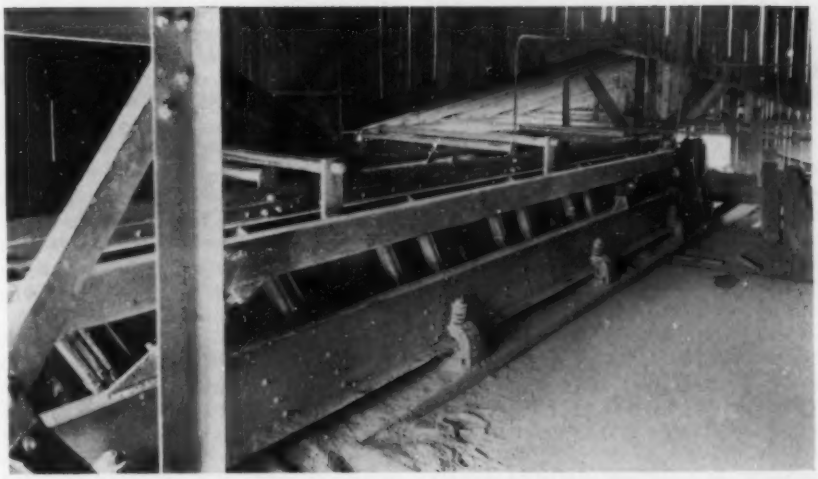
A southern sand and gravel producer is making use of a mechanically vibrated screen to produce a special filter bed sand to a rigid gradation for which he is paid over five dollars a ton, as an example of what can be done in wet screening.

Details are lacking, but the process consists of splitting sand sizes in the lower sieve brackets to very close tolerances by use of a Jigger triple-deck vibrating screen and water applied under pressure. The feed is from a sand settling box spread uniformly over the screen its full width. Water is applied under pressure against the down-flowing sand on each of the three decks to wash the finer particles from those that are larger on the top decks and to drive the smaller particles through the lower deck cloth. The screen has a variable pitch which gives necessary adjustment to the angle at which the water strikes the material. The operation is unique but performs the functions of a dryer and dry screening which ordinarily would be required.

Separation

Progress made in separation principally involves the production of the

Left: Three-roll Hercules mill used to produce agricultural stone in plant of New Castle Lime and Stone Co. Product size is adjusted by changing screen cloth in the discharge end of the mill. Right: In a Ohio plant, water is added over a screen preceding the crusher and sometimes in the crusher to lubricate the mass as an aid in washing out clay



Typical of a common mechanically vibrated type screen extensively used is this 4- x 16-ft. Symons horizontal screen which is installed in a Pennsylvania stone plant

finer graded sands to fit rigid specifications and the removal of deleterious materials from commercial stone and gravel. Some of the newer federal sand specifications in particular, wherein are required as high as 7 percent minus 100-mesh material and the retaining of considerable 50-mesh product, have been troublesome to meet.

Some of the producers who have had the opportunity to furnish that type of material have not had the necessary fines in their deposits to start with. In other cases, existing equipment suitable for ordinary run material has wasted practically all 100-mesh and far too much 50-mesh fines to fill the bill.

To pick an example, an Eastern producer had in his deposit sand testing 3.5 to 7.6 per percent minus 100-mesh and 15 to 16 percent minus 50-mesh. Until he made necessary changes, his product averaged only 0.76 percent minus the 100-mesh and 8.52 percent minus 50-mesh, with 60.80 percent minus the 30-mesh and 77.38 percent passing the 16-mesh.

When a federal contract came his way, the installation of a 10-ft. diameter Nordberg-Wood Auto-Vortex Bowl classifier gave him a product with 2.70 percent minus 100-mesh, 14.54 percent minus 50-mesh, 54.58 percent minus 30-mesh and 68.06 percent minus 16-mesh to meet easily a specification which required a minimum of 2 percent minus 100-mesh and increased 50-mesh. The classifier was installed simply to catch the throughs from a vibrating screen and is now recovering six tons of valuable sand daily that was lost previously.

Other operators have had to use a lot of ingenuity to get comparable results. An outstanding example is the Montgomery Gravel Co. plant at Montgomery, Ala., which has been producing 100,000 tons of concrete sand for use in the construction of the U. S. Lock and Dam on the Warrior river at Tuscaloosa, Ala.

The specification stipulated that 95-100 percent pass a No. 4 sieve, 35-75 percent the No. 16, 10-25 percent the No. 50 and 1.5 to 7 percent the 100-mesh. Before shipments began there was a deficiency in the smaller classifications and the sand bulked between 16-mesh and 50-mesh. The problem was to recover more fines and to get better distribution of intermediate sizes.

The plant was rebuilt (ROCK PRODUCTS, August, 1938, pp. 30-33) and the new plant did a fine job of splitting the various specified tolerances. The rebuilt plant mainly consisted of one 6-ft. and one 8-ft. Auto-Vortex classifiers and two 15-ft. rake-type bowl units preceded by gravity screens with a clever arrangement to catch desired percentages of overflows and settled fines.

A. H. Smith, Branchville, Md., sand and gravel producer, is producing a high grade masons sand with a Link-Belt Rotoscoop, a device ordinarily used for dewatering. The machine, which is installed on a new ladder dredgeboat, is fed minus ⅛-in. material from a revolving screen with sand jacket and also receives the overflow from a sand cone which produces concrete sand from a minus ¼-in. feed. An adjustable overflow weir is lowered to float out mud and silt when excavating contaminated material. The tonnage and grading produced is varied by raising or lowering the weir as well.

Revolving classifiers and log washers are being extensively used to remove clay and surface deposits of soft material on aggregates. For the actual elimination of soft stone, the newest thing we have seen is the passage of unwashed stone through a revolving drum where each particle is subjected to a definite number of falling impacts from a height of six feet. Dust created is collected in a cyclone and merchandised to farmers.

One of the illustrations shows a method of loosening clay in an Ohio plant, before the sand and gravel reaches the sizing and washing screens. The jaw crusher, on the ground, is preceded by a vibrating screen. Water is applied over the screen to lubricate the mass and at times is also introduced into the crusher. The fines by-pass the crusher and join the crushed material in a common bucket elevator.

Portable aggregates plants are used to advantage in some localities to produce material for specific projects. This one, built by the Iowa Manufacturing Co., is being operated near Ladysmith, Wis., to produce 55,000 cu. yd. of washed material

More Effective Grinding

By NATHAN C. ROCKWOOD

Closed-circuit grinding in two- and three-stages in the cement industry is no longer a trend but is becoming general practice. Application, however, is almost as varied as the number of installations. The picture has changed much in a few years. Grinding formerly consisted of feeding materal to one end of a compartment mill and taking out a finished product at the other end. Fineness could be varied by amount of mixed materials fed, ball load, speed, etc., but which compartment or what material was setting the pace no one knew. If we ever return to a more general use of the compartment mill, much will be known about these factors that was not known before.

For example, it is more and more widely recognized that *preliminary crushing* is very essential to efficient grinding. A ball mill as the first compartment of a three- or four-compartment mill is not efficient as a crusher of 1½-in. or larger material; but, more important than that, 1½-in. to dust material can not be fed uniformly. One cement plant operator interviewed in 1938 credited a 20 percent increase in capacity of his compartment mill to crushing the feed in a gyratory crusher to ⅜ in., chiefly because of the greater regularity of feed possible.

Everywhere we find more attention being paid to feeders of grinding machinery. There is obviously an optimum for efficiency of the mill at any one time. If the material fed to the mill is uniformly sized and of constant composition, constancy or regularity of feed is most important; where these factors vary, and they will vary somewhat with ball wear if for no other reason, the amount of feed has to be varied. A clever device known as the "electric ear," described elsewhere in this issue, has been designed to take care of this automatically.

Grinding for What?

The whole trend of grinding, both raw material and clinker, has been toward finer and finer products. The reason for this in the case of the finished cement is obvious, for there is ample proof that fine grinding is at least partly, if not largely, responsible for high early strength, and for what one might term the "cementing value" of the product—there is more actual cementing gel produced in hydrating the finer product.

The reasons for grinding raw materials extremely fine are not so obvious. Theoretically, probably, the finer they are ground the more readily the chemical combination of clinkering takes place. But to form a clinker, or a chemical union, particles of lime, silica, alumina, and iron oxide must come into contact with each other. Apparently, from recent experience, it is possible to have the particles so fine that not only is the stack dust loss increased but the particles are so fine that they remain too long in suspension and are not contacted by the other particles for the needed chemical reaction.

It is our recollection that Dr. Bogue, in his Portland Cement Association researches at the National Bureau oi Standards, early established the fact that nothing was gained by grinding raw materials finer than 200-mesh. Now, it appears, that in grinding to 98 percent through 200-mesh, as many manufacturers are doing, the raw materials are actually being reduced to specific surface areas of around 3500 cm.² per gram, or about twice as fine as good normal portland cement. A specific surface of 3500 cm.² means a lot of material in the smaller micron sizes.

Particles of lime, silica and alumina do not have to be small to bring about chemical reaction or fusion, as every lime burner knows. Great chunks of lime will stick to the kiln lining and reaction between the lining and the lime will take place to a considerable depth. Apparently it is more important that the materials be in actual contact than that they be reduced to micron-size. Just how pulverized materials contact in a rotary kiln apparently no one knows. Here is an opportunity for additional research and study to find out the right size of raw materials for best results—it will probably vary somewhat with different raw materials. In the meantime practice in grinding raw materials might profitably be directed toward cutting off the grinding at 200-mesh, as apparently only loss of power and loss of material and an inferior product result from finer raw materials.

A year ago in these columns we illustrated and commented on the flow sheets of the grinding department of the rebuilt Hudson, N. Y., plant of the Uni-

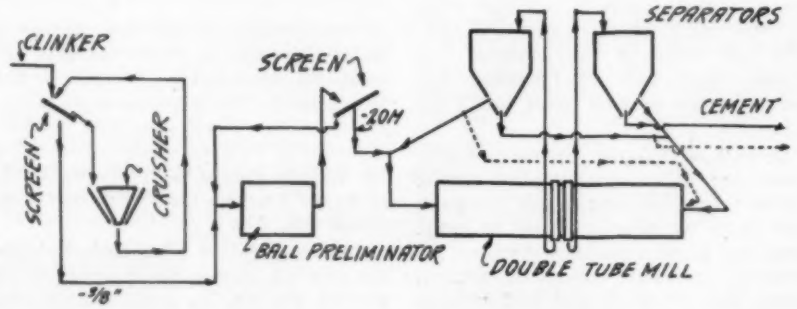


Fig. 1—Original flowsheet, finish grinding, Universal Atlas Cement Co., Hudson, N. Y.

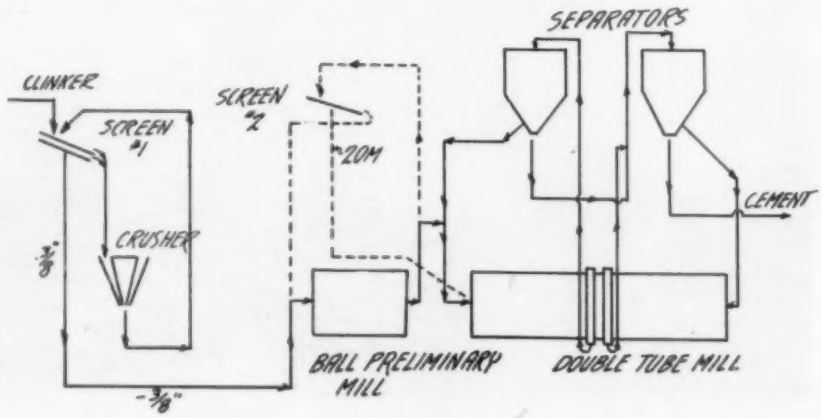


Fig. 2—Flowsheet developed from season's experience at Hudson plant

versal Atlas Cement Co. At this plant it will be recalled that limestone and shale are being used in the dry process, the drying being done by a hot air current on a minus 1-in. hammer-mill product, while it is being passed through an elevator, air separator and a B. & W. mill. This permits circulating loads on the grinding mill of as high as 2000 percent. A circulating load of 1200 percent has been adopted as giving the greatest output of 200-mesh product at best efficiency under normal conditions. Not many raw material grinding installations are designed to handle circulating loads up to 2000 percent; but therein, evidently, lies the solution of avoiding too fine grinding of raw materials. The rub comes, of course, in that separators do not function very efficiently when handling such large circulating loads, but that may possibly be cured by larger separators or by operating two or more in parallel. In wet process grinding the problem of sharp separation at 200-mesh appears to be more difficult.

If the coarse rejects from a raw grinding system are largely quartz, as sometimes happens, it may prove more economical to throw them away and seek a less costly source of silica. Probably a good deal of the excessive grinding of limestone is caused by attempts to reduce abrasive quartz contained in the mix to fine material.

Finish Grinding As Recently Practiced

The original clinker grinding flowsheet at the Hudson plant was illustrated in these columns a year ago as shown in Fig. 1. Fig. 2 shows the flowsheet that resulted from operating experience. As pointed out before, the great advantage of stage grinding is the possibility of experimenting with separate units for the best over-all results. The four, single-deck, 4 x 10-ft. vibrating screens which were closed-circuited with the preliminary ball mill in the original flowsheet have been eliminated because there practically was no plus 20-mesh material to return to the ball mill, when the mill was operating at sufficient capacity for ordinary clinker. One screen was kept as a standby in case the mill is called upon to grind an extraordinarily refractory clinker.

The flow of clinker in the double-ended, center-discharge tube mill has been changed in that the two separators are operated in series, the fines from the first going to the second separator, along with the product of the finishing end of the tube mill. That there are a number of other possible combinations is obvious. Some consideration was given to putting the output of the preliminary ball mill through the air separator before feeding it to the tube mill, but the flowsheet shown in Fig. 2 is the one that probably will be used in 1939.

The problem of most of the plants in the industry is probably how best to fit their present old equipment into more up-to-date flowsheets. A good example is illustrated in Fig. 3 which shows how the Medusa Portland Cement Co. modernized its Silica, Ohio, plant, which is about 12 years old. After operating the three 7-x21-ft. two-compartment mills, first in open circuit and later in closed circuit with air separators, one of the mills was rebuilt into the double-ended, center discharge type ball mill, which now does all the preliminary grinding in closed circuit with vibrating screens; and the other two mills were converted into straight tube mills, which are closed circuited with a single 18-ft. air separator.

At its much older Bay Bridge, Ohio, plant, the Medusa company's finish grinding department consisted of six Kent mills followed by six 5-x22-ft. tube mills, all in open circuit. The best specific surface area obtainable with any reasonable output was 1450 cm.^{2} per gram. The capacity of each unit was about 30 bbl. of finished product per hour. The object was to increase the fineness, or specific surface, without necessarily increasing capacity. By replacing the six Kent mills with two Hercules mills, and by feeding the tube mills with modern devices, four tube mills now grind about the same amount of cement as the former six; and the specific surface area is 1600 to 1700 cm^2. Four of the tube mills are in closed circuit with air separators, two mills to each 14-ft. separator; the fourth mill can be connected into either circuit and is used as a standby.

The simplest adaptation of an old grinding plant to modern requirements that we ran across during the year was at the Middle Branch, Ohio, plant of the Diamond Portland Cement Co. Here two 7- x 24-ft., two-compartment mills were close-circuited with 14-ft. air separators by simply opening up the grid bars in the mill diaphragm from 5/64 in. to ¼ in. The discharge of the second compartment goes to the separator and the tailings of the separator return to the first compartment. The first compartment, about 1/3 the length of the mill, is loaded with 6 tons each of 3½-, 3- and 2½-in. balls, while the second compartment is loaded with 37 tons of 1¼-in. and smaller balls. This has materially increased capacity and permitted attainment of high specific surface areas when desired, without addition of anything but air separators and modern feeders.

A Guess at Future

Raw materials for cement may be ground separately and mixed in pulverized condition afterwards. If all the material is held in the grinding mill until the most refractory is reduced to 200-mesh, it is obvious that some of it is ground much finer than necessary. The ingredient that requires the most grinding in order to make it chemically active is silica. There may be more economical methods of supplying active silica than grinding it.

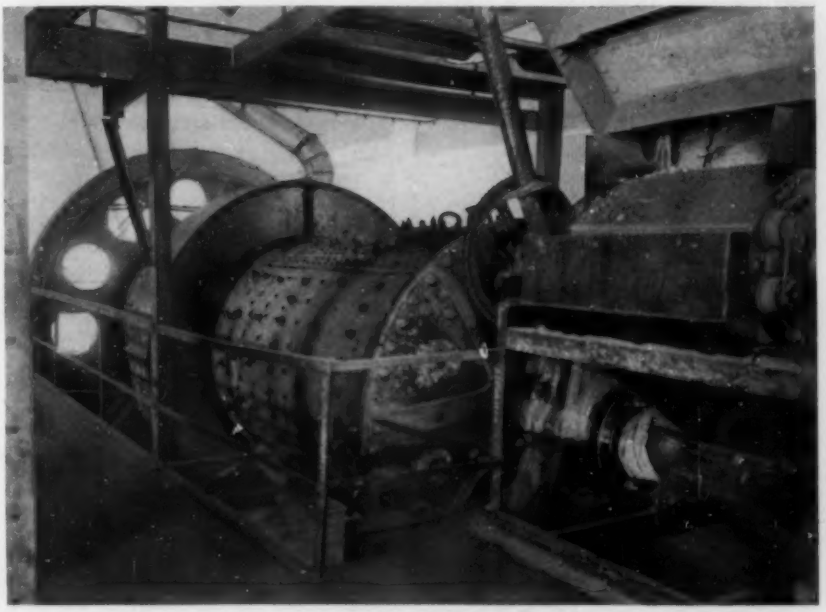


Fig. 3—Old compartment mill rebuilt at Medusa Portland Cement Co.'s Silica, Ohio, plant

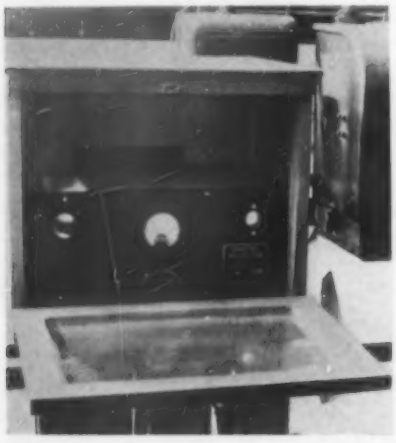
Regulating Grinding Feed With "Electric Ear"

By BROR NORDBERG

Efficient pulverization of materials in ball mills, tube mills and other types where a charge of grinding media performs the reduction by impact or a combination of impact and attrition depends upon a proper and uniform feed. In producing a desired fineness of cement, cement raw materials, lime or other products, there is a definite rate of feed which should not be exceeded.

As the mill becomes choked the efficiency of the mill will fall off sharply. This condition very often reaches the point where the mill can no longer do its work of pulverization. In such an extreme case several hours might be required to empty the mill sufficiently so that it can again grind.

Similarly, there is a lower limit of feed which must be set and maintained to secure maximum capacity of the mill at the desired fineness of product. In many plants, especially in the cement industry, the operator is inclined to be conservative and will sacrifice some output rather than develop a choked mill. He depends largely on listening to the mill to determine by the sound whether it is choked or fed under-capacity. If the sound is loud, it would indicate that the grinding balls are receiving too much contact with each other and with the lining and that there is insufficient grindable material. The operator's ability to detect by sound any variation in feed is generally a measure of the efficiency that can be expected.



Control box of the "electric ear" is in a separate casing with a glass front

"Electric Ear" Removes Uncertainties of Human Element

To take the place of most of the human element in grinding and its uncertainties, the "electric ear" has been devised by the Hardinge Co., Inc., York, Penn., to compensate automatically for differences in the rate of feed. This new device which, like the mill operator, "listens" to the sound of the mill and adjusts the feed rate accordingly, is now in service in one portland cement plant to control raw material grinding and in two others to regulate the feed of cement clinker into a ball mill.

Operating data with these mills are meager as yet, because of the newness of the device and the difficulty in coordinating output and efficiency with and without the "ear" when grinding material that varies widely in hardness, toughness and composition. However, the use of the device has increased capacity and resulted in certain other advantages.

In the closed-circuit grinding of ore where more experience has been gained with the device and actual data have been compiled over a long period of time, capacities have been increased in the neighborhood of 10 to 15 percent.

Operation of the Device

The device consists of a microphone, or sound box, an instrument panel and necessary electrical connections to operate the mill feed mechanism automatically. When the mill sounds "dead" or too quiet, the feed rate is automatically reduced and similarly when the sound is too loud the feed rate is increased. Its purpose is to maintain a constant sound level within the mill, the particular sound level being determined by the operator according to the output and fineness desired. There is only one adjustment required and that is the setting of the sound level, by means of a control knob on the instrument panel. The mill is then kept operating at maximum efficiency, assuming that the microphone is properly tuned, and the operator can devote much of his time to other duties about the mill. That is

"Electric ear" microphone box located near the discharge of the mill primary compartment

the experience of the three plants in which the device has been observed in operation in the cement industry.

The manufacturer recommends that the microphone reflector be placed close to the "down side" of the mill, about 70 deg. below the mill centerline or quite near the bottom, and that the microphone be placed nearer the feed end than the discharge end. This, of course, varies with the type of mill and the size and load of grinding media. By installing the microphone on the down side of a grinding mill, it is subject to the maximum differential in sound and can more readily detect variations in the mill as evidenced by sound changes. The microphone is installed in a vertical position or at an angle closely approaching it.

The power relay, capable of controlling up to a 2-hp. motor at 440 volts, has two contact arms. Assuming the feeder motor to be operated on three-phase current, two phases are broken with the third phase remaining connected outside the control box. The control box is wired up so that the power relay will start the feeder motor when the contacts are closed, and will stop it when the contacts are open. In case the feeder is operated by a standard push button remote control through a relay, the procedure is to shunt the stop switch circuit and connect the "electric ear" relay switch in series with the feeder switch relay coil. The control circuit can be altered should other than 110 volt, 50- or 60-cycle current be used in the ocntrol circuit.

Only One Adjustment To Control "Ear"

Only one adjustment is required: the setting of the control dial to a definite reading, from 20 to 40 microamperes, where mill grinding conditions are considered at their best, and a determination of the exact postion of the cut-off

between these readings. After this determination is made, a decrease in the noise within the mill will be reflected in a slightly lower dial reading which opens the feeder relay stopping the feeder. When the sound increases, the micro-ammeter needle will swing higher, the relay will close, and the feeder will start to operate.

In the experience of the two cement mills where the device has been observed in operation, the "electric ear" has proved to be far more sensitive than the human ear. To determine the best setting, occasional tests are conducted to take into account changes in feed characteristics which affect grinding conditions, such as bin segregation, variations in hardness of materials, etc.

Controlling Feed in Grinding Raw Materials

The North American Cement Corp. at Security, Md., is operating an "electric ear" in the grinding of cement raw materials through a ball mill. The mill is a 66-in. by 10-ft. Hardinge unit driven by a 400-hp. super-synchronous motor through gear and pinion drive and is in closed circuit with a Hardinge air classifier. The "ear" is in circuit with a size 2C Hardinge constant weight feeder driven by a constant speed ¼-hp. motor through a gear speed reducer and chain drive.

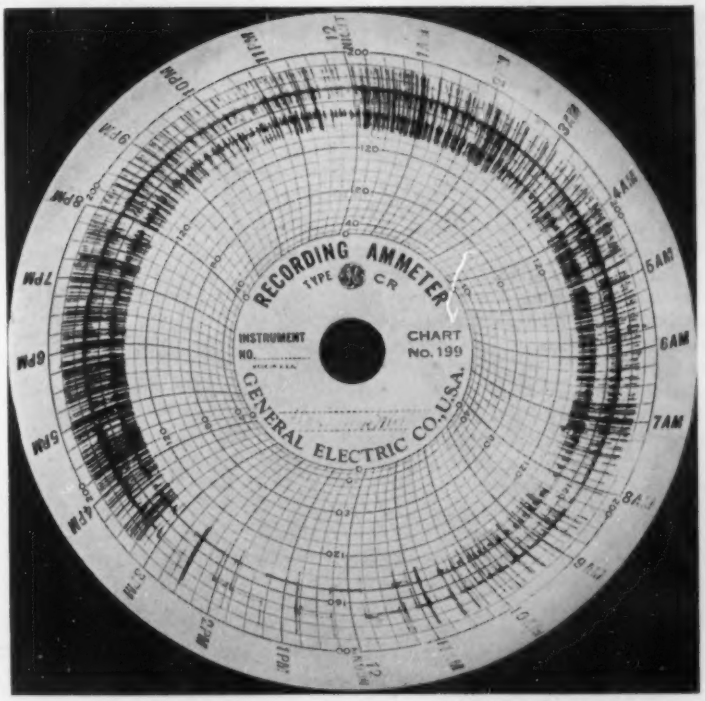
Feed into the mill is from an overhead 30-ton bin containing a minus ¼-in. product which had been reduced through a preliminary hammer mill in circuit with a Hum-mer electrically-vibrated screen. Practically the entire control of the mill is through the precise operation of the "electric ear." The mill speed and ball loading are the same as before installation of the "ear." The mill turns at 17.7 r.p.m. and the ball loading is 25 tons of steel balls graded from ¾-in. to 2½-in. diameters

The "electric ear" microphone is set to maintain a feed rate that will produce a kiln feed product 99.9 percent through 100-mesh at the greatest output. The mill, with the "ear" attachment, is producing 25 tons of kiln feed material per hr. which is supplemented by the output of 14 Fuller mills to produce the entire kiln demands. Output of the ball mill never varies more than 20 percent, which is very good performance when variations in hardness, toughness and composition of the materials fed into it are taken into consideration. When harder than ordinary material is fed into the mill, the pulverized product, of course, cannot leave the mill until it reaches a definite fineness. This means a building up of material within the mill and the feed is shut off. If the mill becomes choked for any reason, the operator need not be concerned, knowing that the mill load must drop to the point of best efficiency before any more feed will be taken in.

Similarly, if soft, highly grindable stone is encountered, the mill discharge will be stepped up to the point where it can produce more tonnage of the desired fineness. An accurate check of these conditions is obtained at this plant on a continuous recording graph, hooked up into the feeder circuit, which starts and stops the feed.

A glance at the chart by the operator as he happens to walk through the mill room will tell him how the instrument is functioning and also what the nature of the feed may be. Normally, the feeder is in operation for one minute and off for 10 seconds, alternately, which by experience indicates that the mill performance is at an optimum efficiency.

If the chart shows the feeder to be "kicking off" too frequently, the setting of the sound box can be changed. With the feeder running full without any shut offs, weights can be added to the feeder fulcrum or the sound box can be adjusted in the other direction. These adjustments are usually done only on occasion, and appreciable changes in operation caused by a decided change in feed of stone, perhaps from a different part of the quarry, are usually known in advance by the plant chemist. The microphone is located very close to the mill shell where it slopes toward the feed end.



"On and Off" chart of feeder controlled by "electric ear" at North American Cement Corp. plant at Hagerstown, Md.

Controlling Clinker Feed to Ball Mill

Medusa Portland Cement Co., at the Silica, Ohio, plant, has an "electric ear" operating to control the fresh feed into a clinker-grinding ball mill. The mill is a former 7- x 22-ft. compartment mill which has been converted into a double-end feed and center discharge preliminary ball mill.

The device is located below the center line on the fresh feed end of the mill, the other end of the mill receiving rejects from six 5- x 4-ft. Tyler Hum-mer screens. Fresh feed enters the mill axially over a pan feeder chain-belt driven by a constant speed motor with the device connected into the feeder motor electrical circuit. The ball charge in this compartment totals 16.4 tons of forged steel balls from 2½- to 5-in. in diameter.

The bed of clinkers carried by the feeder is regulated so that the feeder will occasionally shut off. Clinker is being ground in the ball mill all to pass 20-mesh, with the rejects returning into the far end of the mill, where, if the front end of the mill is run without overloading, there is no danger of choking. Grinding efficiency in this hook-up depends upon a proper circulating load between mill and screens, which is maintained very close to 75 percent by having automatic feed control. The mill has a feed of 150 bbl. of clinker per hr., an output of 150 bbl. per hr. of minus 20-mesh material ready for tube-milling, and 75 bbl. re-circulating through the system.

Cement Discoveries in Foreign Countries

By F. O. ANDEREGG

An outstanding event of the past year was the Congress of Cement Chemistry held in Stockholm in June, where numerous scientific aspects of cement were discussed by the world's best specialists: R. H. Bogue reviewed the constitution of portland cement; W. Büssem applied X-rays to cement chemistry; G. E. Bessey described the hydrates of calcium aluminate and silicate; F. E. Jones talked on the complex calcium aluminates; T. Thorvaldson presented his experiments with hydrothermal reactions with portland cement; Schläpfer dissertated on the reactions of portland cement with water; L. Forsen lectured on the chemistry of retarders and accelerators; N. Sundius went into the constitution of aluminous cement clinker; G. Assarsson discoursed on the reactions of aluminous cement with water; F. M. Lea contributed his viewpoint on the chemistry of the puzzolanas; while S. Greitz-Hedström, of soil science fame, gave some very interesting suggestions concerning the physical structure of hydrated cements.

A considerable advancement has been made in the last ten years: the study of the glass phase of portland cement clinker has contributed to our more exact understanding of that important commercial material; the use of X-rays often has been useful in analysis both of clinker and of hydration products; numerous studies of the products of hydration have shed considerable light on that difficult subject, although plenty remains to be explored in that field; in aluminous cement clinker the principal mineral being monocalcium aluminate, which on hydration and according to special conditions may yield a variety of hydrated salts at ordinary temperatures, but only one, $C_3A.6H_2O$, at elevated temperatures; the subject of puzzolanic activity is in a very unsatisfactory state, with considerable doubt as to whether the beneficial effect is physical through filling voids and making a denser concrete, or chemical by using up free lime or by forming a silicate gel which swells in contact with corrosive solutions.

High Points of the Year

In addition to the Congress, other high points of the year include:

1—Ferrari uses an equivalent amount of iron and alumina so as to produce C_4AF only, together with a larger amount of the silicates to give a cement very resistant to corrosive solutions, including sea water. This may be improved somewhat by incorporating good puzzolanic materials.

2—Anselm and Schindler get the apparent unit weight of clinker and claim good correlation with actually determined strengths, clinkers running from 87 to 93 p.c.f. giving best results.

3—Nagerova and Petrova determine silica in leach water from concretes with the aid of ammonium molybdate in sulfuric acid solution, compared colorimetrically with picric acid solutions.

4—Sanada offers evidence that magnesia is not taken up by the portland cement minerals unless insufficient lime is present to form the di-silicate.

5—Jander and Wuhrer, however, after careful X-ray studies conclude that both di- and tricalcium silicates may take up tricalcium aluminate to the extent of 6 to 7 percent at 1400 deg. C.

6—Tavasci gets interesting microscopic results on etching a polished clinker surface with a 1 percent borax solution.

7—Eitel finds that calcium fluoride has a valuable mineralizing action in forming tri-silicate, but very rapid cooling is required to prevent reversal.

8—Feret observes that calcium chloride and sodium sulfate have little effect on the soundness of cement. The former does accelerate early strength, without having much effect on later strengths. Glaze is useful in securing density so as to reduce opportunity for sulfate attack.

9—V. Rodt believes that finely ground blast furnace slag and trass not only act to densify, but also have some specific cementing action in the presence of free lime.

10—Nagai believes that high silica blended cements can be made not to have any more shrinkage than standard portland, while showing much better resistance to sulfate solutions.

11—Nagai has studied aluminous cement for refractory purposes, paralleling experience in this country. He finds lime added to improve workability of the concrete also lowers its melting point.

12—Mussgnug, on burning portland cement clinker from slags in reducing atmosphere, notes a change in color from dark gray to chocolate brown with reduction in setting times and early strengths. Later, however, the strengths come up to normal.

13—For masonry mortars, Krüger prefers lime-cement mortars for most units, a straight lime mortar being only regarded as suitable for non-load bearing walls built of certain clay and slag units. For heavy duty masonry, portland cement should be the only cementitous material. Well burned units are also required for load carrying.

14—Drögsler has built a number of masonry piers with German brick and mortars of different strengths. The formula covering the strengths suggested is of the form $S = aB - c/M + D$, where B is the brick strength and M, the mortar, while a, c, and D are constants, the latter depending upon the shape of the wall, pier or panel.

15—Mortarless masonry, using Heraklith strips fabricated from excelsior bonded with magnesium oxysulfate, has been proposed in Vienna, for reducing costs of masonry construction. Kristen and Hermann find the walls buckle under loads of about 55 p.s.i. and that they undergo considerable compression so as to damage severely the stucco, whether applied before or after loading. Only slight improvement in heat loss was noted, while the sound transmission reduction was below 50 db. Cracks were sure to develop in the stucco, whether loaded or not, to permit moisture to pass through the wall.

16—Keil and Gille found that concrete can be stored quite a considerable time beyond the initial set and then reworked, no water being added, without affecting the strength obtained. The mass must have sufficiently good workability to be placed to form a dense concrete, an important point. Concrete can also be mixed a very long time without harm, the economic factor limiting the time of mixing. In fact, the long mixing is often very helpful.

17—Rodt believes mixtures of magnesia and sawdust can be made to set up hard when simply mixed with water.

18—Dutron is strongly in favor of vibration for placing concrete. He finds it superior to tamping for the drier mixes. Density and strength are improved and shrinkage is reduced. Vibrating again at hourly intervals improves the compressive strength slightly and the flexural strength more up to the fifth repetition.

19—A valuable test for free lime in portland cement clinker is described by Schläpfer and Eisenwein, involving the use of clove oil. Highly birefringent (1.59-1.57), rhombic crystals of calcium eugenolate form directly on the CaO indicating its location. Hydroxide of Ca and Mg are turned yellow, but neither they nor the other constituents of ordinary clinker form the eugenolate crystals.

Pit-to-Plant Methods Brought Up-to-Date

Substantial Savings Possible By Modernizing Stripping, Blasting and Excavating

By RALPH S. TORGERSON
and BROR NORDBERG

Close-up of tunnel portal at Monocacy, Penn., quarry of John T. Dyer Quarry Co., being stemmed for large blast, under supervision of du Pont engineers

Delivery of stone and sand and gravel from quarry or pit to plant represents an appreciable item in cost of production and in many plants affords more opportunity for cost reductions than the processing operations to follow. Accordingly, producers of all kinds of rock products are attempting to move overburden, to better their preliminary operations and to deliver material into the crushing and screening plant just as cheaply as they can.

Stripping

Conventional methods of stripping, by power excavators loading into trucks and industrial cars, prevail. Tractor-combination machines, some of which combine the operations of excavation, hauling and dumping in one unit, are finding acceptance in some operations, notably where the overburden is heavy and the tonnage to be hauled is great.

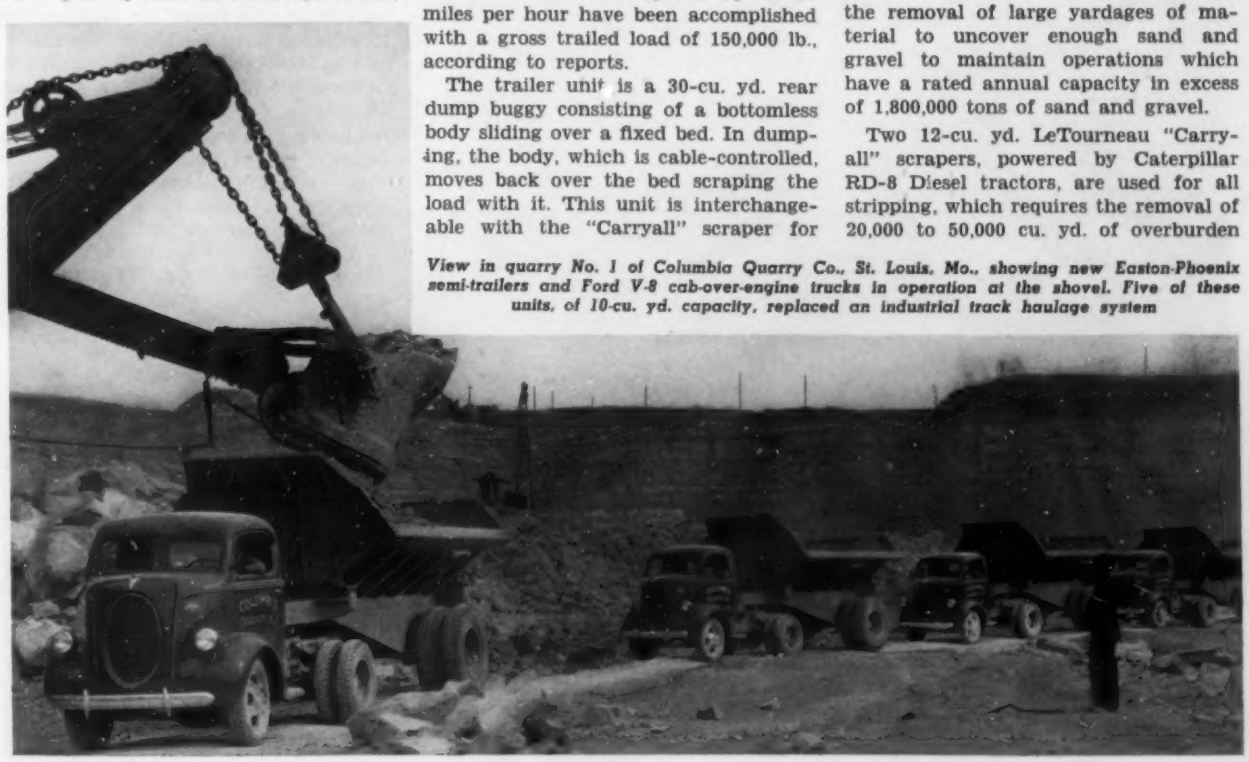
Two new machines developed by R. G. LeTourneau, Inc., Peoria, Ill., the "Tournapull," a haulage unit powered by Caterpillar Diesel, and the "Tournatrailer," a large capacity carrying unit, are typical of the latest of this type equipment used in commercial operations. This combination is being used for stripping in the quarry of a large midwestern portland cement plant.

The "Tournapull" is steered by independent control of each wheel and has an added feature which enables one wheel to be held stationary while the full engine power is transmitted to the other. The purpose of this design is to enable the machine to "wiggle out" of muck and mire by a series of semi-circular movements. Speeds up to 20 miles per hour have been accomplished with a gross trailed load of 150,000 lb., according to reports.

The trailer unit is a 30-cu. yd. rear dump buggy consisting of a bottomless body sliding over a fixed bed. In dumping, the body, which is cable-controlled, moves back over the bed scraping the load with it. This unit is interchangeable with the "Carryall" scraper for operation with the "Tournapull." The one is loaded by shovel while the other is a self-loading carrier.

Large capacity earth movers are being used to reduce stripping costs by the McGrath Sand and Gravel Co., Lincoln, Ill. This concern, which operates four sand and gravel plants in scattered locations, has centralized its stripping operations to serve all plants by the installation of equipment that is mobile. At these plants the overburden is not excessive but stripping involves the removal of large yardages of material to uncover enough sand and gravel to maintain operations which have a rated annual capacity in excess of 1,800,000 tons of sand and gravel.

Two 12-cu. yd. LeTourneau "Carryall" scrapers, powered by Caterpillar RD-8 Diesel tractors, are used for all stripping, which requires the removal of 20,000 to 50,000 cu. yd. of overburden



View in quarry No. 1 of Columbia Quarry Co., St. Louis, Mo., showing new Easton-Phoenix semi-trailers and Ford V-8 cab-over-engine trucks in operation at the shovel. Five of these units, of 10-cu. yd. capacity, replaced an industrial track haulage system

Type of stripping equipment used by McGrath Sand and Gravel Co. for centralized operations. This particular unit is shown stripping overburden from the top of a hill to open a new gravel pit near Curtis Bay, Md.

annually at each plant. The two units handle the stripping very rapidly and are kept busy on other jobs for much of the time. Among them are the hauling of sand and gravel to supplement pumping operations, the building of track grades, driveways, dikes, etc.

Blasting

The operation of blasting has become more scientific as regards better breakage, safety and the adaptation of methods to limiting conditions outside the quarry.

As far as the selection of drilling equipment is concerned, there has been a continuation of the trend toward the use of wagon drills in place of well drills, or blast-hole drills. A wagon drill is a pneumatic type drill mounted on columns, the entire assembly being mounted on wheels. It drills smaller holes than a well drill, but when spaced closer and loaded with high explosives, blasting with these holes often gives fragmentation requiring no secondary drilling and blasting. One concern has tried making a traction "wagon drill" with a gasoline motor-driven air compressor mounted on caterpillars which are driven off the same gasoline engine. The detachable bit on all types of pneumatic drills has gained in acceptance at the expense of forged drill steel.

In certain rock formations, particularly in hard rock with high faces, tunnel blasting supplemented by well drill shooting and the bringing down of several hundred thousand tons of rock by one shot is considered most economical.

To illustrate such a blast, we mention one recently made at the John T. Dyer Quarry Co., Monocacy, Penn., quarry, under the supervision of E. T. Wolf of E. I. du Pont de Nemours and Co. In this blast, 38,000 lb. of "Nitramon" safety blasting agent were used in the two tunnels and about 15,300 lb. of dynamite in the well-drill holes.

The front tunnel, 135 ft. long with 60-ft. to 76-ft. burden, was loaded with 17,000 lb. of "Nitramon" B and C and the rear tunnel, 200 ft. long with 50-ft. burden, was loaded with 21,000 lb. of the same blasting agent. Fourteen 130-ft. deep well-drill holes were loaded with a total of 15,300 lb. of dynamite. These holes were double row spaced 25 ft. to 30 ft. apart with 40- to 65-ft. burden. The illustration shows the height of the tunnel portal, and the size of the blast.

Another illustration, taken at the Moores Lime Co., quarry at Durbin, Ohio, represents the typical average limestone blast and well drill practice. In this blast about 9000 tons of stone were brought down, using eight 6-in. holes spaced 14 ft. apart and 16 ft. back from the face. The loading was 1100 lb. of Hercules No. 1 "Gelamite" in the bottom and 1100 lb. of No. 6 "Hercomite" at the top, for all eight holes.

Blasting practices in quarries located adjacent to residential sections are often limited by court restraint upon complaint of residents and must be controlled to the satisfaction of all con-

Above: New trailer of 30-cu. yd. capacity pulled by two-wheeled "Tournapull" to remove overburden in the quarry of a cement plant

Right: Dieselized truck with Gar Wood hoist and body unit of 16-cu. yd. capacity used in stripping by the Marquette Cement Manufacturing Co. at LaSalle, Ill. Loads are side-dumped into gondolas

Right: In the quarry of an Eastern cement plant, large heavy duty trucks powered by Diesel engine deliver stone to the crusher. Costs are unusually low

Left: Gray Stone Quarries, Johnstown, Penn., use this carrier, a Koehring "Trail-Dump," to transport stone from one crusher to another a mile or more distant

cerned if operations are to be allowed to continue.

As an example of what is being done in such cases, we have in mind a southern stone plant of 100 ton hourly capacity that had been enjoined from operations because of alleged damages to residences. Upon appeal the court ruled that blasting was not a legal nuisance provided each shot did not exceed 70 lb. of explosives.

To be on the safe side, the company developed a method of blasting, which could not be detected by sensitive seismographs 500 ft. away and yet would bring down sufficient stone for full-time operation.

The quarry face was reduced from 18 ft. to 15 ft. and rock is being "jam shot" in front of the shovel. Drilling is done by wagon drills and a line of 1¾-in. holes is set back 3½ ft. from the face and 5 ft. apart. Each of the holes is loaded with five ½-lb., 60 percent dynamite sticks, and five holes are shot instantaneously. Blast holes are connected in groups of five to be shot instantaneously and a connection is made to the main lead upon a signal by the quarry foreman.

After the first shot, other groups of holes are similarly connected up in turn at intervals of two minutes to make certain that any vibrations from the previous blasts had been dampened. In about 30 minutes the blasting operation is completed with safety and only 12½ lb. of dynamite are used in a single blast. The explosion is so light that workmen only need to stand back a short distance and blasting can be done ahead of the shovel at most any time.

Manufacturers of explosives must be given much of the credit for greater safety in blasting practices. Aside from actual supervision of blasting by their engineers they have developed safety blasting agents and accessory equipment that have taken much of the hazard out of blasting. "Nitramon," a du Pont product, is an example of a safety blasting agent that is finding acceptance. Atlas Powder Co. has brought out a new type Manasite blasting cap. The new cap contains an initiating material chemically known as Hexanitromannite which is said to be less sensitive to impact and friction than the detonating compounds commonly used, thereby substantially increasing the margin of safety in the event of mishandling.

Excavation

In the pit excavation of sand and gravel and in stone quarrying there are no particular trends evident unless it be the use of more electrified power shovels in the larger plants and an increasing number of small, high-speed shovels, both gasoline and electric, in the smaller and medium-sized plants.

Manufacturers of drag scraper and slackline cableway equipment have made improvements and refinements of great interest to producers excavating sand and gravel in that manner. Sauerman Bros., Inc., Chicago, for example, has

Blast in quarry of Moores Lime Co. illustrating typical well drill practice in bringing down 9000 ton of stone

One of several Diesel-electric locomotives purchased by Lehigh Portland Cement Co. for haulage in the Oglesby, Ill., and Iola, Kan., plants. Rating of this one is 150 hp. and 20 tons

introduced a system of oil hydraulic control for use with scraper and cableway hoists as an alternative to the standard air, electric or hand lever control. This new feature is claimed to give the operator more sensitive control of clutches and brakes. The same concern has re-designed the Crescent scraper bucket and has equipped the buckets of 2-cu. yd. capacity and over with an overhaul cable. The purpose of this feature is to increase digging ability of the bucket by overcoming the occasional tendency of the backhand cable to tilt the rear end of the bucket.

Hydraulic Excavation

In the South in particular, where dredges predominated in the excavation of sand and gravel, pumping capacities have been increased for the same pump size and power utilized, by the installation of new-type pumps. The Columbus Gravel Co., Columbus, Miss. (ROCK PRODUCTS, December, 1938, pp. 26-28) increased its capacity 15 to 20 percent by installing a 10-in. Amsco counterflow pump to replace a standard 10-in. pump. The new pump has a 2-way Amsco thrust bearing which is adjustable to allow setting of the impeller up to 0.002 in. of the pump shell. Capacity is 250 tons per hour and the drive is a 250-hp. G. E. motor running 585 r.p.m. In this plant and in many others a suction line of 2-in. greater diameter than the pump size and discharge line is used.

A large sand and gravel producer in Louisiana has developed a jet which operates on the injector principle and, according to reports, is getting extraordinary capacities from his pumps. The idea is not new (others have been tried and failed), but this particular design has been operating satisfactorily for several years.

The device consists of a straight pipe extension to the suction line and an elbow through which water is introduced by an auxiliary water pump into the annular space between two pipe cylinders. By introducing a large volume of water which is forced in the direction of the dredge pump a vacuum is created and the dredge pump merely acts as a booster. Mixtures of 60 percent solids are handled to the plant. On one particular pump, using a 10-in. Amsco counterflow pump with a 12-in. suction line and a 10-in. water pump, capacities of over 800 tons per hour of salable product are claimed, using a larger capacity and higher speed motor than would be ordinarily specified for driving a 10-in. pump.

Haulage Systems

The trend in delivering rock products from the quarry or pit is continuing toward the use of more trucks and, in large operations, the use of light trucks to haul heavy tonnages in semi-trailer carriers is on the increase. In industrial track haulage systems, the Diesel-electric locomotive has come to the front for the economical haulage of large loads and a number of installations of this type have been reported.

Some interesting figures have been compiled by Columbia Quarry Co., St. Louis, Mo., comparing costs of operation of a track and car haulage system with those for truck haulage recently introduced. Five 10-cu. yd. Easton Phoenix semi-trailers and Ford cab-over-engine trucks are in operation at one of the quarries to deliver stone from two 3-cu. yd. shovels to the crusher.

Costs for haulage were reduced about 1⅛c per ton of delivered stone, the former figure for gasoline locomotive haulage being computed on 1937 costs and tonnage. About one-quarter of the per ton costs for car haulage, or most of the difference in comparative costs, is for labor costs in the quarry incidental to maintenance, which have been largely eliminated.

This item, slightly under 1c per ton, is the labor cost for moving out the track and clearance of the ledge before making a big shot, for the steam shovel crew in casting over the shot to clear for track relaying, for relaying dinkey tracks, daily track maintenance and for moving track toward the bank of stone at the completion of each cut.

It was estimated that the total delay in plant operation for moving the shovel and for track work was 55 hours for a shot of approximately 65,000 tons. Comparative costs were calculated on the basis of performance of the truck and semi-trailer combinations before any major repairs were made necessary, but estimates are for a saving of 1c a ton to include such maintenance.

An Eastern portland cement manufacturer, in remodeling its crushing plant, has installed trucks powered by Diesel engine in the quarry for operation on a 900-ft. haul without grade. The trucks are Model 87Q Hug Roadbuilders equipped with Easton Phoenix 6-cu. yd. bodies. The engines are Buda K428 vertical 4-cylinder Diesel engines which develop 107 b.h.p. at 2600 r.p.m. Each truck handles about 800 tons of stone per 8-hr. day at a cost of 55c for fuel for the entire day.

A few producers have developed truck bodies of original design to fit their particular purposes. A southern portland cement concern has developed its own semi-trailer body to be hauled by Ford V-8 trucks. The capacity is about eight tons of stone to be hauled up a stiff grade to the crusher. The design is novel, with one side open to reduce the needed lift of the quarry shovel and the body is mounted off-center toward the open side. This feature is to compensate for the shovel operator's tendency to place stone on the far side of any carrier and to equalize the load distribution on the springs and tires. A pneumatic lift hoist is used to tilt the body at the crusher.

Quarry buckets, or skips, of the types manufactured by Dempster Bros., Inc., and Brooks Equipment and Manufacturing Co. are found desirable in some quarries, particularly in those of moderate size or where it is necessary to select stone for various purposes.

Combustion Control In the Cement Industry

By WILLIAM E. REASER*

During the past 20 years there have been marked developments in the design and operation of rotary cement kilns. Until about 1920, kilns generally retained the same simple forms as they had from the day the rotating cylindrical shell replaced the old upright shaft type of cement burning apparatus. True, kilns increased in size as manufacturers strove for greater output, but little consideration was given to the problem of economy of operation, particularly with respect to the number of B.t.u.'s which were being consumed per barrel of clinker.

With the close of the War came a period of keen competition and rapidly rising costs, especially of fuel, factors which were responsible for tremendous improvements in heat economy. Waste heat boilers, chain systems, coolers for recovery of heat in the clinker, and shell insulation to reduce radiation losses were but a few of the many devices aimed at increasing the overall efficiency of the burning operation. However, even a well designed, insulated kiln equipped with clinker cooler and waste heat boiler can show a poor fuel economy if it is not operated correctly. It is within this sphere that the interesting advances of the past five years seem to be significant.

Not many years ago, the "burner" had complete control of the factors involved in the burning operation with nothing more to guide him than his visual observation of the burning zone through glasses, the color of which he chose himself; an examination of the finished clinker when it became cool enough to handle, possibly an hour or more after it was discharged from the kiln; and a periodic report of quality from the plant chemist. Next followed the period of the Orsat, indicating draft gauges and pyrometers but no great returns were ever attributed to these instruments because they were only indicating and no one in authority could ever check chart records to see whether or not the burner had been guided by the indications, and in many instances operators paid no attention to the instruments because they had never been educated to their use. Another reason attributed for this state of affairs was that very often the chemist in those days was one whose technical and practical knowledge of combustion principles was insignificant, but he had the last word about the burning operation. He knew from his results when clinker was not satisfactorily burned, but he cared little about any of the other matters such as the quantity of fuel used, the high maintenance cost of the refractories, secondary combustion with often subsequent plugging of dust chambers and boilers by the fused materials, or excessive exit gas temperatures which, coupled with poor water conditions, caused numerous outages of steam generating equipment because of bursting boiler and superheater tubes.

Until about the time of the depression, the real problem of control of burning was never adequately attacked. However, new sources of economy had to be found by the cement manufacturers. In addition, specifications for general cement called for continuously higher standards, and more and more special cements were demanded, requiring more careful and scientific preparation in all departments of the plant, including the burning process. Not long ago some specifications actually demanded that in order to obtain certain business, it would be necessary to show the purchaser of the cement, charts of kiln speed and burning zone temperatures, these temperatures to be held within very narrow limits. Such requirements undoubtedly indicate a trend which may have a distinct influence on cement manufacture in the future.

New Developments In Scientific Burning

The movement toward more scientific burning and the application of control has been rather slow but appears to be progressing steadily. Certainly, a few of the developments such as the radiation pyrometer, the photo-cell pyrometer, automatic control of draft and air flow, improvements in coal feeding apparatus

*From a recent address by Mr. Reaser, assistant professor, mechanical engineering, Lafayette College, Easton, Penn., before a meeting of the Anthracite-Lehigh Valley Section, American Society of Mechanical Engineers.

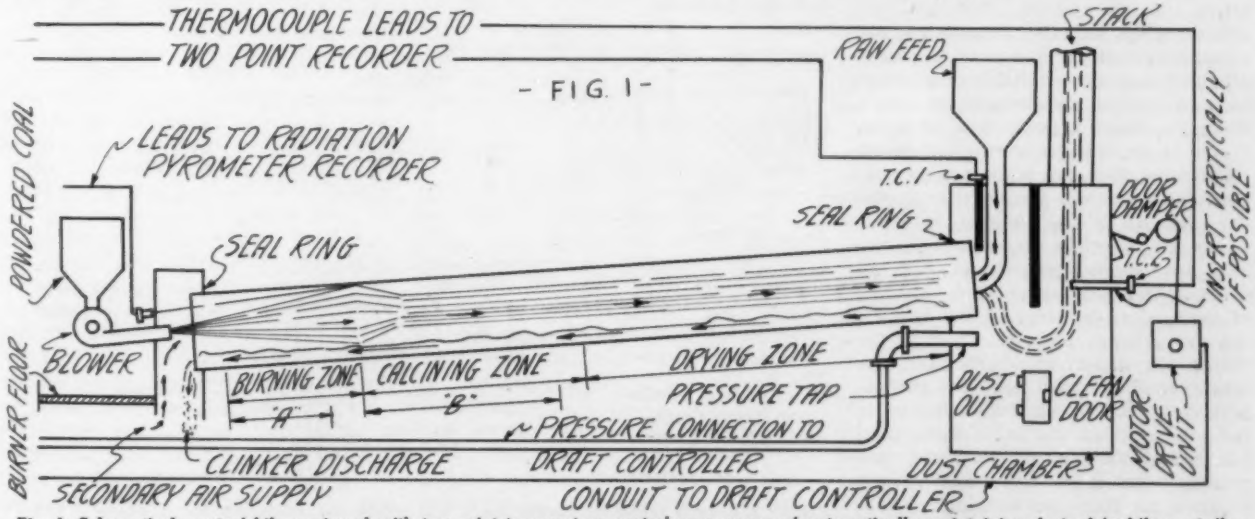


Fig. 1: Schematic layout of kiln equipped with two-point temperature control as a means of automatically maintaining desired fuel-flow, air-flow relation. Note location of radiation pyrometer to record temperatures in the burning zone

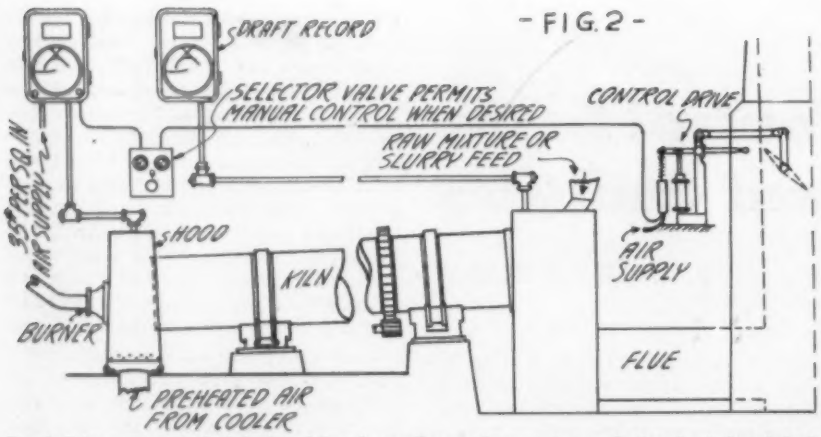


Fig. 2: Schematic control of draft in kiln where all secondary air is supplied under induced draft

which are readily susceptible to control by automatic devices, and improved automatic gas analyses are worthy of attention.

To begin with, what are the immediate factors in the burning of the raw material? They are the size and shape of the kiln, the fuel and air supply, the quality and quantity of the raw material, and the quality and quantity of the discharged clinker. As for the first of these, once a kiln is designed and built, the burner can do nothing about making changes, in the ordinary course of burning clinker, though of course this factor may have a distinct effect on what *procedure* of operation is finally decided upon.

Further, for some time past it has been recognized that it is desirable to have as nearly as possible a constant load in the kiln, a condition aimed at by tieing in the speed of the kiln with the speed of the raw feeder, either by a mechanical or electrical means. The limiting element in such a scheme is whether or not there is delivered a positive quantity of material per revolution of the feeder. Though this scheme is not entirely successful, it has eliminated from the hands of the operator just one more variable over which he had control and because of which there has been a great deal of grief. It might be mentioned that probably this development has worked more successfully in the wet process than in the dry, because if the buckets or other device for carrying the slurry to the kiln are cleaned periodically, for all practical purposes a positive quantity of material is delivered to the kiln. In the dry process, however, there is involved the design of the bunker, the condition of the raw feed, and the inherent tendency of such installations to rat-hole or flood. As one cement man has repeatedly said in discussing this problem, the most important devices required for thorough satisfactory kiln operation are feeders which have positive control over the supply of both raw material and coal.

As for maintenance of a constant quality of raw feed, the wet process has its advantages over the dry, though generally it is governed sufficiently well that the burner is not required to "juggle" his kiln in order to overcome variations in the chemical analysis of the material. Certainly, at least, this problem is far more near a satisfactory solution than is the burning process at the front of the kiln.

Fundamentals of Proper Handling of Kilns

Hence, only those other factors, proportioning of the fuel and the air, and the burning of the clinker, are to be considered. Just one word of caution, however; though general principles are to be laid down it cannot be too strongly emphasized that each individual kiln is its very own problem and that a thorough engineering study of every installation must be made before any system of operation and control is suggested.

However, it is more or less generally agreed that there are just two fundamental schemes of handling a rotary kiln:

(1) To operate at a constant speed of kiln and vary the combustion rate, that is, vary the quantity of fuel and air, to maintain the desired temperature in the burning zone.

(2) To operate at as nearly a constant combustion rate as the firing equipment will permit, and vary the speed of the kiln to maintain required burning zone conditions.

The first of these schemes demands an apparatus to show continuously in some fashion the condition of the exit gases in order that when sufficient fuel is being fired to carry the load, the correct quantity of air is supplied to burn completely all the combustible without having too great an excess of air.

An automatic gas analyzer, electrically operated, to indicate and record CO_2 and $CO+H_2$, has been used successfully, particularly on long kilns where exit gas temperatures are comparatively low and the problem of getting the sample of gas is not quite so difficult as on short kilns where exit gas temperatures are between 1300 and 1800°F. The greatest objection is that so far no automatic feature to control the air supply has been applied and the human element thus remains in the picture. And one further point, when the fuel flow is changed, it is desirable to change the primary air flow in order that it remain as a constant per cent of the total air required for combustion. Except for but one type of firing pulverized coal by means of a unit mill equipped with a special control, I know of no means whereby this requirement can be satisfactorily met. The automatic gas analyzer, if it operates 100% efficient, only shows whether or not there is sufficient total air to burn out the

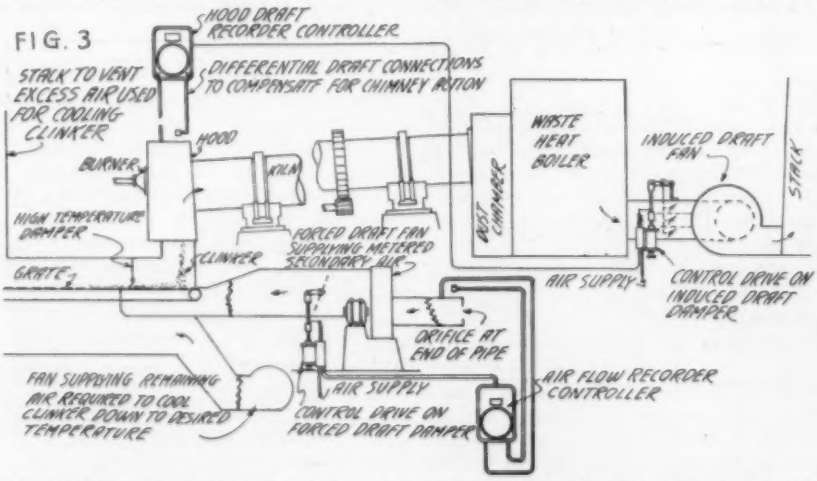


Fig. 3: Schematic layout of control for a kiln where the secondary air is supplied under forced draft

combustible. There is also a two-point temperature apparatus shown in Fig. 1, which has been successfully applied to maintain automatically the desired total air when the combustion rate is either held constant or is varied. It will be noted, however, that there should be sufficient distance between thermocouples 1 and 2 to give a temperature drop of about 40 deg. or more, and the set-up should be such that under ordinary operating conditions cleaning doors should not be opened because a variable infiltration of air would upset the control apparatus.

The second scheme of operation is somewhat more susceptible to automatic control. It is possible to apply apparatus to kilns to maintain automatically the necessary air flow and draft conditions, and then adjust the fuel flow until the desired combustion conditions prevail, as shown by a series of gas analyses taken by means of a hand Orsat. Once having determined the correct fuel flow-air flow relation required to burn the necessary quantity of material per hour, within certain limits as governed by the type of

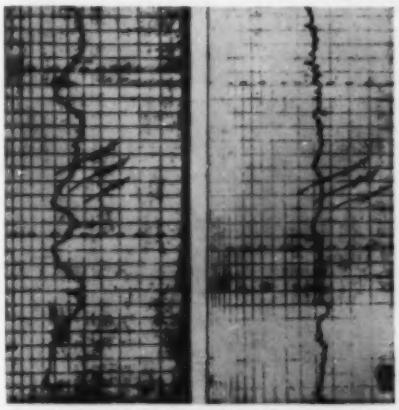


Fig. 5: Two charts recording the temperature in the burning zone of the kiln. Curve 1, to the left, records the results when the fireman made no effort to use the radiation pyrometer as a guide, while Curve 2, to the right, shows the results obtained when the radiation pyrometer is properly used

fuel feeding apparatus, it is possible to operate at this combustion rate and burn by varying the speed of the kiln.

Fig. 2 shows a schematic control of draft in a kiln where all secondary air is supplied under forced draft. A draft recorder is located at the feed end of the kiln in order that variations in the draft differential across the kiln (probably caused by rings) may be noted.

Fig. 3 gives the schematic layout of control for a kiln where the secondary air is supplied under forced draft. An extra fan is indicated if more air is required for cooling the clinker than is required for combustion purposes. In both layouts it is assumed that the kiln is operated at a constant rate.

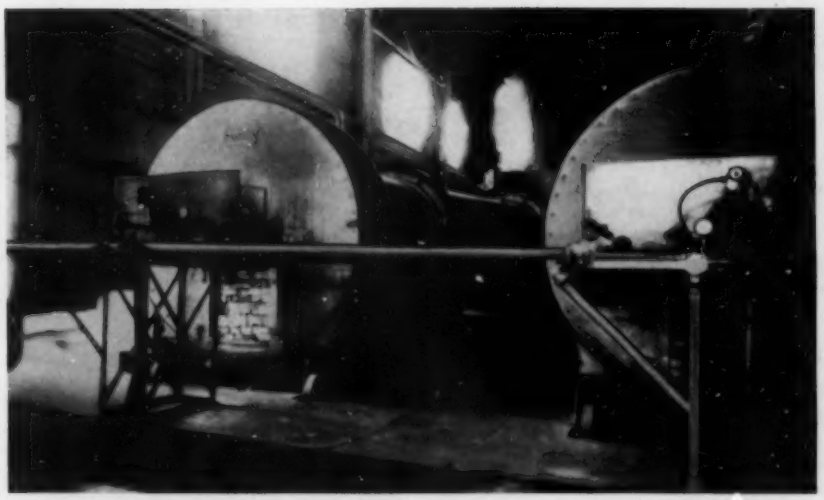


Fig. 4: Radiation pyrometer installation mounted on two oil-fired rotary kilns

When the firing of the fuel is done by an apparatus which will continuously supply practically a weighed quantity of coal, as with a unit mill, and the air-flow is controlled by automatic means, this problem is not so difficult and checking of the settings would not be required at too frequent intervals. However, when the fuel feeder is governed by volumetric measurement and when coal screws are dependent upon the free flow of coal to them from the bunker, precautions have to be taken. Experience has shown that adjustments of the fuel feeder can be made on the basis of daily tests of exit gas conditions and that, except for unusual circumstances, it is possible to operate with a fixed fuel rheostat between test periods.

Having once put the fuel and air under control, there remains the necessity for controlling the burning to maintain desired temperatures at which to finish the clinker. The radiation pyrometer and the electric eye have been used to guide the operator to make hand adjustments of the speed of kiln, or to do this job automatically.

What are some of the results to be expected from a more scientific burning process?

To name a few: fuel economy; more constant production; more even quality of product with consequent effect in the finish grinding process; longer life of the refractories; elimination of secondary combustion and consequent troubles in dust chamber and boiler passages; elimination of the human element; and finally, an all-over economy without the necessity of a large capital investment.

THE SWEDISH SKANSKA CEMENT CO. recently completed extensions and modernization of its main plant at Limhamn, in southern Sweden. This work included the construction of two kilns 475 ft. long, said to be the second largest in Europe, a cement mill with a capacity of 25 tons per hr., and five large silos. The improvement cost about $1,250,000, and the productive capacity has been increased.

CEMENT MILL WORKERS have lodged a strong protest with the Texas legislature against the reported use of foreign cement by the highway department. C. A. Killingsworth, chairman of the executive board of the Texas cement mill workers union, estimated that 140,000 bbl. of cement were imported into Texas from foreign countries last year. Considerable cement is being imported from Belgium. It is reported that the low prices for this cement, made with cheap labor costs, have made it possible to pay shipping costs to Texas, unloading charges, and a rail haul of 100 miles and underbid the locally manufactured product.

A COMMEMORATIVE PLAQUE and memorial gates at St. John's Church, Wakefield, England, have just been dedicated to the memory of Joseph Aspdin, who is credited with being the inventor of portland cement. The original shaft kiln used by Aspdin still exists. The *"Leeds Mercury"* on November 6, 1824, made the only recorded mention of his patent when it was brought out. It read as follows: "We hear that Joseph Aspdin, bricklayer of this town, has obtained a patent for a superior cement resembling Portland stone."

ROSENDALE CEMENT CO., Rosendale, N. Y., has reported a carload shipment of cement to Salt Lake City, Utah, for use by the Utah Highway Commission. It is reported that this natural cement was selected for special use due to its resistance to alkaline soil conditions.

Fuel Burning Applied Under New Conditions

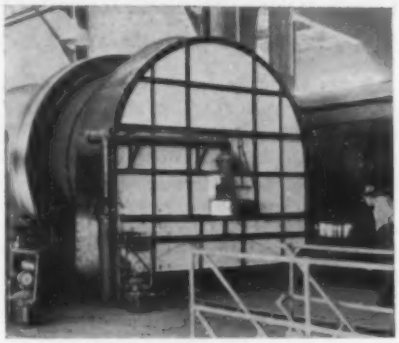
By RALPH S. TORGERSON
and BROR NORDBERG

Greater fuel economy and more uniform control of burning conditions in the rotary kiln are the outstanding calcining objectives of the lime and portland cement industries reflected in installations made in 1938. The direct firing coal mill has become further established, as a means toward saving coal in most cases and also to control burning conditions.

There are now at least six manufacturers who build mills for direct coal firing of rotary kilns. In the few cases where such equipment has not reduced the number of pounds of coal burned per ton of lime or per barrel of cement, installation is justified on the basis of burning uniformity and its effect, in the case of the cement industry, on clinker quality and grindability.

Direct-firing coal mills have likewise been perfected to fit them more closely to kiln needs. The B and W mill, in addition to feed control, now has a thermostatic control feature. The thermostatic control equipment assures constant temperature (and therefore constant volume) of the air going to the pulverizer. This is accomplished by damper control at the cold air inlet. A thermocouple in the hot air duct leading to the fan actuates a motor which is direct-connected to the damper.

The automatic feeder regulator on this mill is an arrangement to facilitate uniform burning of clinker by providing adjustment of the coal feed to meet changing kiln requirements. The feeder regulation is said to respond quickly to changes in size, grindability or moisture content of the coal and to promote fuel economy by maintaining a constant ratio of coal and air.



Compare this modern kiln hood with older installations. This is an oil-fired kiln at the Redwood City, Calif. plant of the Pacific Portland Cement Co.

An individual coal mill, new to the industry, was placed into operation by the Kosmos Portland Cement Co. at Kosmosdale, Ky., during the year to fire the kilns and the dryers for stone and shale. This mill grinds coal particles while they are suspended in heated air taken from the kiln hoods and is otherwise operated much on the order of other accepted types.

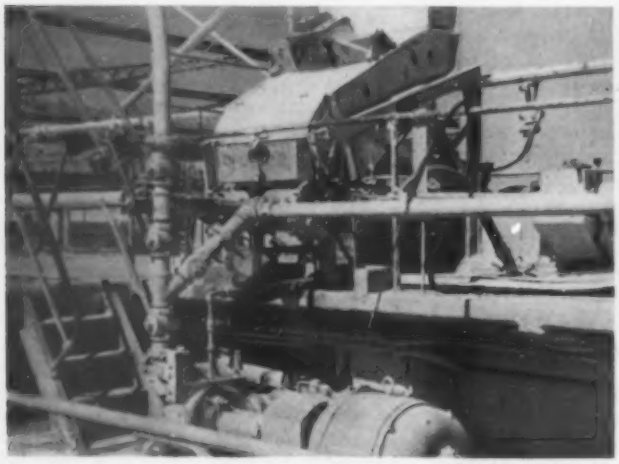
Kiln control equipment such as automatic draft controls, recording radiation pyrometers and continuous gas analyzers are continually playing a greater part in cement manufacture. Better control has enabled some manufacturers to increase kiln speeds.

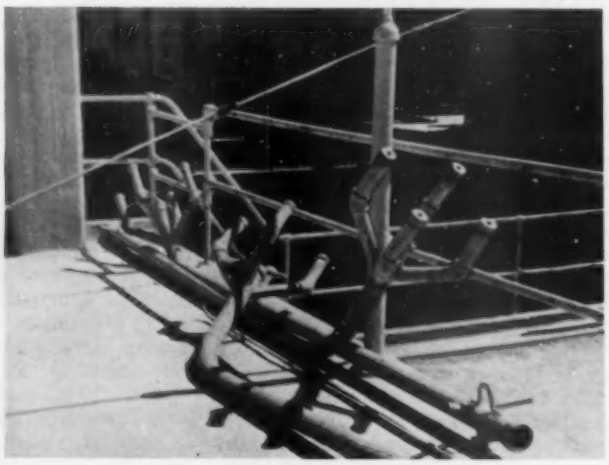
As to kiln lengths and diameters there is considerable disagreement and no particular trend, although the newer kilns continue to be longer than those of a few years ago. The newest kilns of the Lone Star Cement Corp. at Houston, Texas, and in Argentina have restricted calcining zones. The kiln diameters are 11 ft. with a calcining zone 10 ft. in diameter. These are long kilns and the calcining zone is 155 ft. long.

This is contrary to usual practice which has been to enlarge the calcining zone, on the theory of delaying the material at this point. In the case of a long restricted zone, this would appear unnecessary, and by restricting the diameter the velocity of the kiln gases must be speeded up and the ratio of material in the kiln area exposed to the gases is increased. Heat transfer is a function of the speed of the incandescent gases as well as of the surface exposed in the kiln. Therefore, the Lone Star practice may be more correct theoretically than the expanded zone idea in the case of long kilns.

Coolers

A concerted effort is being made to reduce costs in the grinding of cement. As a result, two-stage cooling is common today. A good percentage of plants are quenching the hot clinker suddenly, upon discharge from the kiln, to create a brittle or glassy structure, which is more grindable and apparently reduces the undesirable influence of free





Left: In the spray system of drying and feeding slurry into the kiln, a vibrating screen is used just ahead of the slurry pump to remove coarse particles. Right: Slurry nozzle as it looks removed from the kiln

Electric vibrating dryer used by Utah Copper Co. (made by Allis-Chalmers Manufacturing Co.) to dry concentrate in the molybdenum recovery plant. Material is agitated and conveyed over a heated surface by a Utah electromagnetic vibrator. The dryer is 50 ft. long and 30 in. wide

lime and magnesia. This is followed by another cooler to reduce temperatures as far as is practicable, as a pretreatment for grinding.

The Valley Forge Cement Co., Catasauqua, Penn., has installed coolers for primary and secondary temperature reduction that are of new design. The coolers are described as movable inclined grate coolers, and are of the air-quenching type. Clinker temperatures are dropped from about 2500 deg. F. to 800-1200 deg. F. in the first cooler and the product of the second cooler is 120 to 140 deg. F. The arrangement is comparatively simple and occupies very little floor area.

Kiln Feeds

The trend is toward harder burning of some clinkers and more accurate control of kiln feed as an aid to reducing autoclave expansion and, incidentally, permitting better grindability. One of the older dry process plants in the East has found an aerated feed into the kilns through inclined screw conveyors to be the solution to flooding. Small, open top hoppers are filled from the blending bins by a system of screw conveyors and an elevator, utilizing a circulating load. Overloading is controlled electrically, using rotary feeders from the blending bins, the operation of which is governed by the amperage indicated in the motor drives for the handling equipment.

Dryers

The latest development in drying actually operating in a dry process cement plant, referred to briefly a year ago, is the raw grinding department of the Universal Atlas Cement Co. at Hudson, N. Y. Here, the raw materials are dried simultaneously with the pulverizing operation, which is done in three mills closed-circuited with air separators and bucket elevators. Air, heated by a thermostatically-controlled oil furnace, is introduced through the elevators and into the air separators.

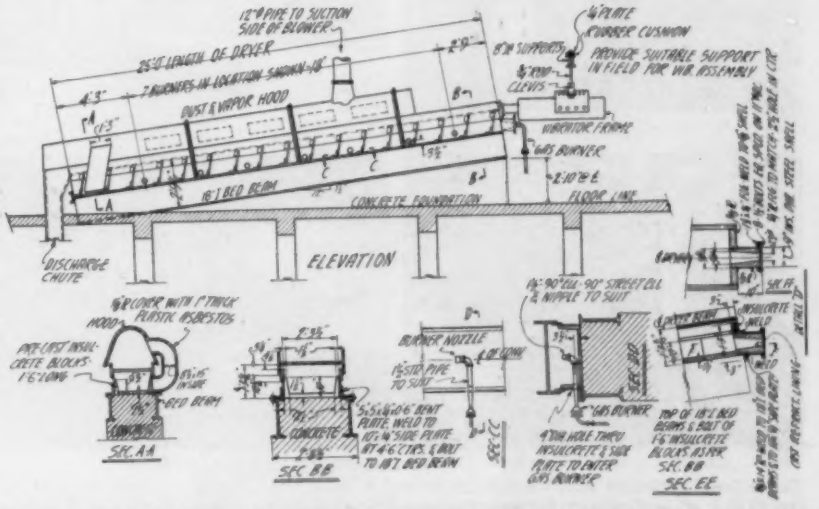
A current development in the portland cement industry is the adaptation of the spray system of drying, which is not at all new, to feeding slurry into a cement kiln. Three or four plants in the United States have recently tried out a new method, which is in use in a number of foreign plants. A similar method was tried out in this country a number of years ago.

The success of the spray system of slurry feeding apparently depends on several factors among which are: (1) elimination of *all* coarse particles ahead of the nozzles (to keep them from being plugged); (2) a high pressure pump; (3) adjustment of the spray nozzles to the size of the kiln and other factors of the particular installation; (4) facilities for recovery of stack dust.

Accompanying illustrations show a new type of dryer in operation at the Utah Copper Co., Magma plant, used for drying filtered concentrate in the molybdenum recovery plant. This might have possibilities for slurry drying or, by a few changes, for cooling clinker.

The long rotary kiln for the burning of lime has now been in operation long enough to find something out about its performance. The main difficulty seems to be in the formation of kiln rings from the fusion of coal ash with the kiln lining, but experience in firing these kilns and in the selection of proper fuels has practically eliminated this condition, at least in a large Eastern plant. This operator claims a fuel ratio of 5:1 without any CO present in the stack gases. Another of the longer kilns is producing high calcium lime with a ratio of about 3.9:1. In a third case the stone or lime was unable to withstand the abrasion in traveling over 300 ft. through the kiln and much of the feed is lost in the stack gases.

In shaft kiln operation, we know of one plant that is successfully operating direct-firing coal mills, a practice that has always failed in the past. A high magnesia product is being burned with a fuel ratio of over 5½:1 using a 12,000 B.t.u. coal. The coal mills are small, high-speed hammer mills and the draft is induced. The product is used for mason's lime.



Details of Utah electric vibrating dryer showing method of applying vibration at one end of pan and how heat is applied to the bottom of the conveyor trough by natural gas burners. Use of a separate combustion chamber for burning coal, wood, gas or oil could be adapted to operation of the dryer

Some Interesting Scenes In West Coast Cement Mills

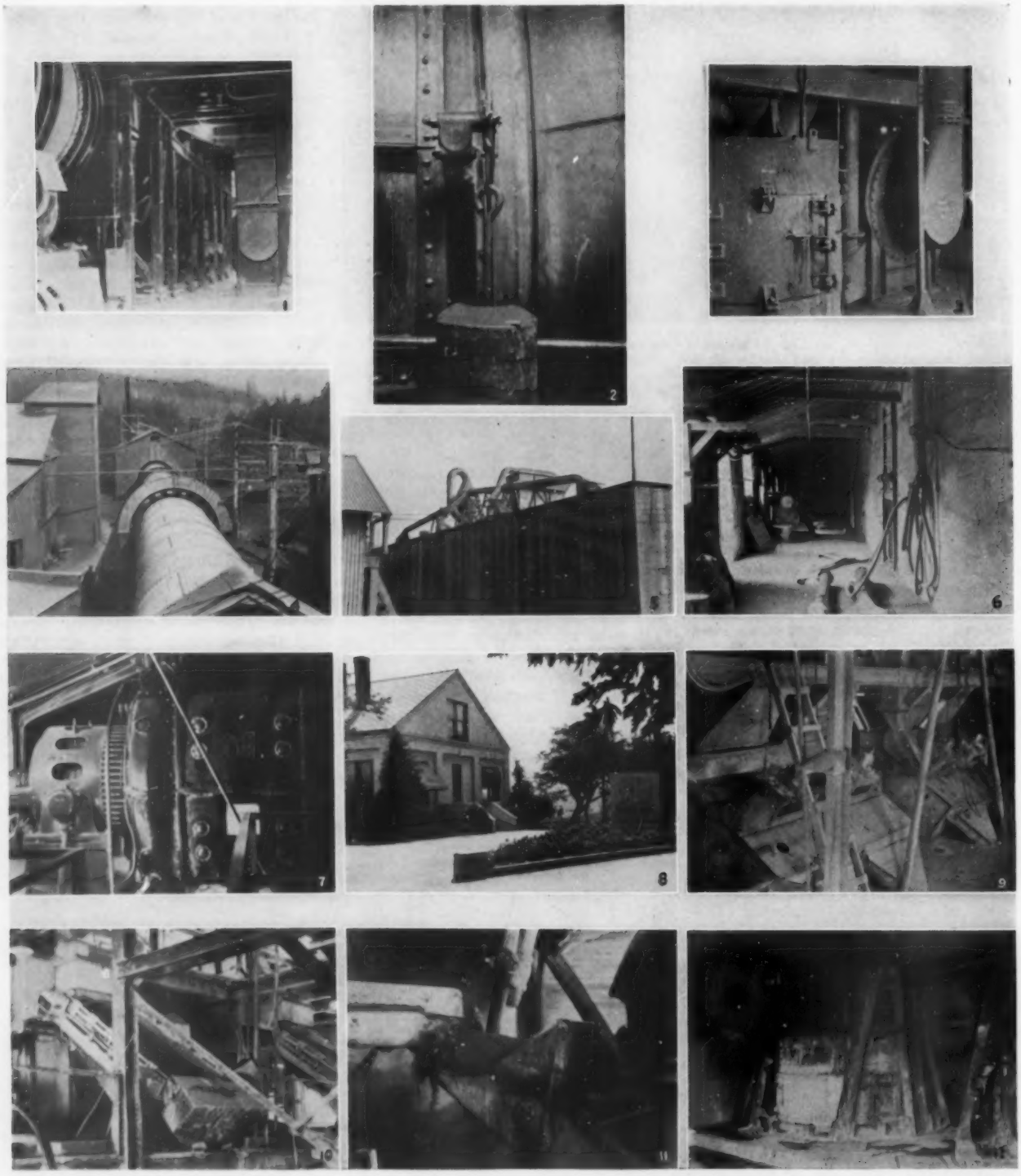


Fig. 1: Lepol preheater or calciner on upper end of rotary kiln. Fig. 2: Polysius seal ring on firing end of kiln, Spokane Portland Cement Co. Fig. 3: B & W coal mills at Olympic Portland Cement Co., Bellingham, Wash. Fig. 4: Northwestern Portland Cement Co. single-kiln plant. Fig. 5: Rectangular cement storage bin with Fuller-Kinyon pump lines. Fig. 6: Storage bins unloaded with portable Fuller-Kinyon pump, Northwestern Portland Cement Co., Grotto, Wash. Fig. 7: F. L. Smidth motor and reduction gears for Unidan mill drive. Fig. 8: Office of Olympic Portland Cement Co., Bellingham, Wash. Fig. 9: Clinker screens. Fig. 10: Slurry screens, Olympic Portland Cement Co. Fig. 11: Feeding into side of Hercules mill used as a wet preliminary grinder. Fig. 12: Mill used as a preliminary wet grinder, Superior Portland Cement, Inc., Concrete, Wash.

Some West Coast Practices Are Different

By NATHAN C. ROCKWOOD

To renew personal acquaintance with West Coast *operations* as well as *operators*, the writer recently spent several weeks in the states of Washington, Oregon and California. His only regret is that the time spent was five weeks instead of five months; for there were too many things left for later visits.

From the trip as a whole the most lasting impression was the comparative quiet of the Northwest and the building activity of the San Francisco Bay and Los Angeles sections. The Northwest is undergoing a transition from a great lumber manufacturing section to something else—as yet unknown. Most of its other great natural resources, of which its climate is one, have yet to be utilized. It is still a young country, in need of population, capital and of more enterprizers with vision.

Were it not for the Grand Coulee dam cement orders, the cement mills in this section would be hard put to find enough business to justify operation. The sand, gravel and crushed stone business is largely dependent on highway jobs, where commercial producers must compete with contractor-owned temporary plants. In the Seattle section, one sand and gravel plant is amply able to supply the entire demand.

Turning to the San Francisco Bay region we found a lot of activity in building, particularly small residential stuff under F.H.A. loans. The Golden Gate World's Fair also provided a considerable market. In Los Angeles there was small residential construction, and federal flood prevention jobs which provide some business for both cement manufacturers and aggregate producers.

It is obvious that California is gaining population rapidly at the expense of the rest of the country; and where population is growing many new facilities must be supplied in addition to housing, as for example waterworks, sewerage, street pavements, etc. There are apparently a great many people in California who manage to live without visible means of support, but somehow or other facilities to take care of them are provided — and this means business for the providers.

Spokane Cement Plant

One of the most interesting plants in the Northwest, of course, is that of the Spokane Portland Cement Co., just outside of Spokane, Wash. It is the only installation in this country of the Lepol kiln and one of the earliest to have the Polysius pneumatic mixing and blending of dry raw materials and a Cera cement pump. This plant has the distinction of having no tube or compartment mills, all raw grinding being done in a 5½ ft. x 10 ft. Hardinge mill and all the finish grinding in a Type B Babcock & Wilcox mill, in closed circuit with a Sturtevant air separator.

The blending system has operated satisfactorily since its installation in 1935. It is a compressed-air method of keeping the ground raw materials in suspension, "boiling" them, until they are thoroughly mixed. By means of special valves the amount of air admitted to any of the correction tanks or bins may be varied.

The Lepol kiln is said by Superintendent F. D. Neill to be functioning satisfactorily after three years of operation. It is certainly saving fuel since it requires an average of but 65 lb. of coal (12,000 B.t.u.) per barrel of cement, when making 1000 bbl. per day. It has done better than this during long test periods under constant expert supervision. The most delicate part of the process is the nodulizing of the dry raw materials—balling them up into pellets about the size of marbles is the aim. These nodules or pellets travel through a drying chamber and then a burning chamber, into the rotary kiln, on a traveling grate. All of the hot gases from the kiln have to be drawn through the bed of nodules on the traveling grate.

The kiln is sealed at both ends; consequently all the air for combustion is drawn either through the rotary cooler or goes in with the coal from a B. & W. unit pulverizer. Unless the raw material is perfectly nodulized it is difficult to pull the air necessary for combustion through the traveling grates, and the kiln operates with something less than the needed air or oxygen for complete combustion. In other words, there are frequently reducing conditions in the kiln. Also, more dust is pulled from the nodule bed and returned to the feed than would be the case if the nodulizing process were perfect.

Since 1935 all finish grinding has been done in a B. & W. mill. During that period specifications have called for more and more specific surface. The company has had no insurmountable difficulties in meeting these specifications, grinding regularly to 1900 sq. cm. per gram at a rate of 60 bbl. per hour with a seasonal average power consumption of 7 kw.h. per bbl. (for the mill alone). This cement is about 22 percent minus 7½ microns, and 99 percent minus 200-mesh, around 96 percent minus 325-mesh. There is an excellent distribution of particle size and tests give 400-500 lb. strengths at 7 days.

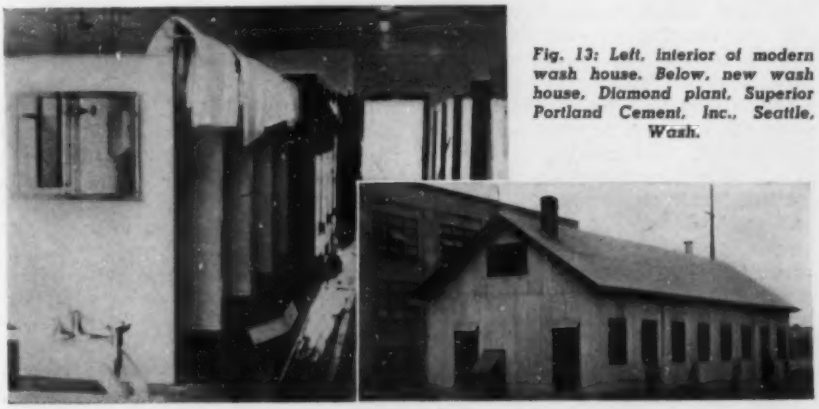
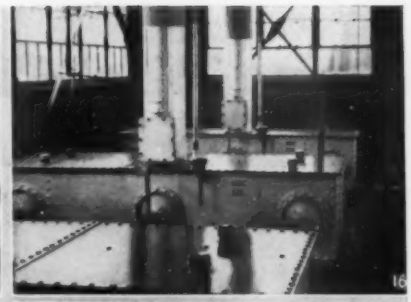


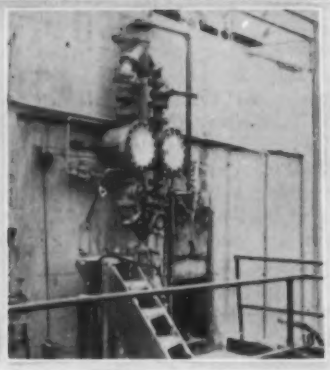
Fig. 13: Left, interior of modern wash house. Below, new wash house, Diamond plant, Superior Portland Cement, Inc., Seattle, Wash.

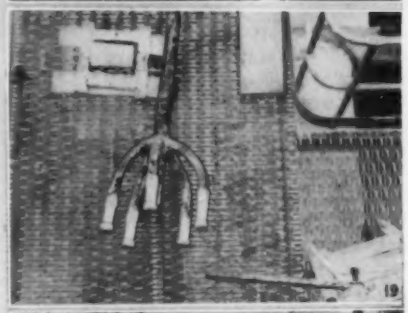
Northwestern Cement Plant

Another plant of more than ordinary interest is that of the Northwestern Portland Cement Co., Grotto, Wash. It is interesting because it was one of the earliest plants of its type—a single-kiln, economically-built plant, designed to be economically operated, and dependent on only a small share of the business in its territory for prosperity. Under present conditions and those of the past few years, owners of such small plants appear to have fared better than those of large plants.

The Grotto plant is probably the only one in the country which operates without the services of a full-time superintendent. Arthur G. Smith, a Seattle consulting engineer, is both part-time superintendent and chief chemist. A quarry foreman and a plant foreman







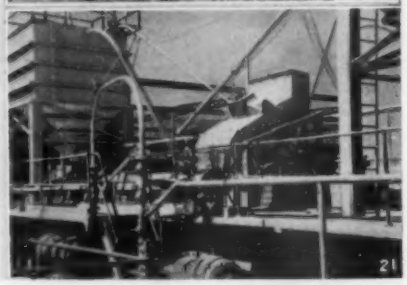


Fig. 14: Laboratory equipment for crushing and pulverizing. Fig. 15: Chemist's laboratory. Fig. 16: Dust collecting equipment. Fig. 17: Enclosure for Western Precipitation Co. dust collector unit. Fig. 18: Equipment for spraying slurry into kiln. Fig. 19: Dyckerhoff slurry sprays. Fig. 20: Looking down on Wilfley pump and other equipment for Dyckerhoff slurry spray. All views from Fig. 14 to Fig. 20 were taken at the Diamond plant, Superior Portland Cement, Inc., Seattle, Wash. Fig. 21: Dyckerhoff slurry spray system in operation at Southwestern Portland Cement Co. plant at Victorville, Calif.

take care of production problems between Mr. Smith's visits to the quarry or plant. Only four operators per shift are required for full operation of the cement plant.

C. T. W. Hollister, president, and Mr. Smith departed from customary practice last summer in the construction of storage facilities for finished cement. Instead of building cylindrical silos, a series of rectangular reinforced-concrete bins with a flat roof were constructed; and instead of an elaborate system of pipes and valves and pumps or conveyors under the bins, they are entered at floor level through slide doors, and emptied by means of a portable Fuller-Kinyon pump, of the type used for unloading box cars of bulk cement. With this device bulk cement is loaded for Grand Coulee dam at low cost of storage and handling. While the rectangular bins contain more concrete for the same storage capacity than silos, they were much more easily and quickly constructed by inexperienced labor.

A Steady Long Time Producer

The Olympic Portland Cement Co. plant at Bellingham, Wash., interested the writer because it is so well kept up; for here is one of the oldest wet-process plants in the Northwest still using practically all its original equipment, which was installed 25 years ago. Of course, much new machinery has been added, and capacity increased, but the old equipment is still in good working condition—the F. L. Smidth kilns, tube mills, Kominuters, etc., the mills belt driven by the original motors.

Raw grinding is done in three stages: (1) three No. 85 Kominuters in closed circuit with three 48-in. x 8 ft. Hummer Type 400 vibrating screens, with No. 907 Ton-Cap (Ty-Loy metal) 20-mesh wire cloth; the screen opening is about 0.077 in. square; (2) the minus 20-mesh goes to a No. 20 Smidth tube mill; the over-size is returned to the Kominuters; this circulating load is about 100 per cent; (3) the output of the tube mill is split to two No. 18 Smidth tube mills (6½ ft. x 10 ft.) loaded with ⅝-in. Cylpebs. The final product is 90-92 percent through 200-mesh. This equipment can grind raw material for 3000 bbl. of cement per day.

The finish (clinker) end is two-stage grinding with three Smidth No. 85 Kominuters in closed circuit with two double, enclosed, 42 in. x 8 ft. Hum-mer screens. These have screen cloths with 0.025 in. square openings, and the circulating load is about 90 percent. The throughs go to three No. 18 water-jacketed (spray casing) Smidth tube mills. The Kominuters use 4-in. and smaller balls, the tube mills ¾-in. and smaller. The capacity is 3000 bbl. per day.

For manufacture of some of the newer super-fine cements, one of the latest type Smidth 3-compartment Unidan mills has been installed. This is operated in open circuit with 4-in. balls in the first compartment, 2-in. in the second and 1-in. in the third. This mill will probably be equipped with an air separator in closed circuit with the first compartment.

Superintendent A. F. Krabbe prefers the Kominuter, screen and tube-mill combination for fine grinding (1800 to 2450 cm^2 per gram) because it permits each piece of equipment to be operated at maximum efficiency, or for maximum capacity.

Last year the three kilns were equipped with B. & W. direct-firing coal mills.

The Concrete, Wash., plant of Superior Portland Cement, Inc., is well known to all cement manufacturers.

Power Costs Go Down

Industry Using More Scientific Control Apparatus, Added Overload Protection; and More Diesel Units

By RALPH S. TORGERSON

Power developments during the past year point to an increasing use of Diesel units, more applications of scientific control apparatus to power-driven kilns, grinding mills, etc., and greater use of overload protection devices on electrical equipment.

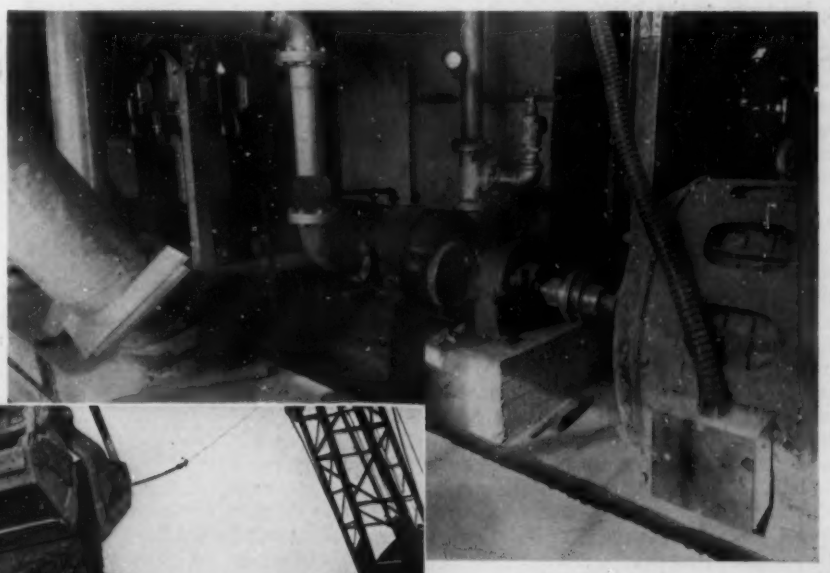
Installations of electrical equipment for crushers and tube mills have been largely of the synchronous type motor, either direct-connected or with V-belt drive. Magnetic clutches have been used between synchronous motors and crushers to reduce the shock on the motor. One advantage of the V-belt drive is that, with the ratio of reduction that can be used with this drive, a much higher speed and therefore a less costly motor can be used.

There has been a further acceleration of the trend toward the purchase of power by cement plants and the use of individual motors to drive machinery. An example of this is the modernized Hudson, N. Y., plant of Universal Atlas Cement Co. After the cost of purchasing electricity became so low as to make it uneconomical to continue generation of its own power, a 1250-kv. a. frequency changer was installed to produce 25-cycle current from incoming 60-cycle to supply the plant's old motors. All the new motors, however, are driven direct from the 60-cycle supply purchased. The use of individual motors permits interlocking control so that if trouble develops at one machine, all conveyors and feeders involved in the particular process are stopped. All motors are protected against overload by dust-tight air circuit breakers. The Southern States Portland Cement Co., Rockmart, Ga., has similarly changed over to the use of 60-cycle motors after discarding its old power house electric equipment.

Installation of interlocking control equipment also has been made in many of the larger sand and gravel and crushed-stone plants. A new crushed stone plant in Kentucky has a central station from which all operations of the plant can be controlled by push buttons. Screens, conveyors, and elevators are interlocked and controlled by means of combination line starters and air circuit breakers. Expenditures for protective equipment of this kind have been found profitable in the long run as emergency shut-downs are costly.

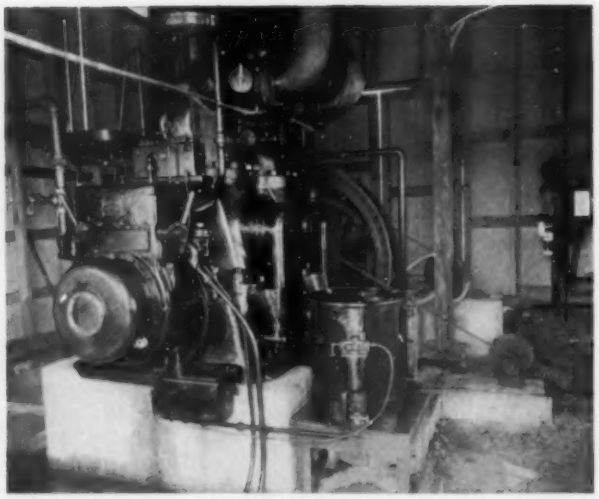
While no new cement mill power plants have been built in this country in the past year the recently completed Argentine Portland Cement Co. plant is of interest. At this plant there are two oil-burning boiler units, designed for a normal capacity of 11.02 tons of steam per hr. at 29 atmospheres absolute pressure and a steam temperature of 400 deg. C. with an efficiency of 86 percent at normal load. Generating equipment consists of two turbo-generators of the radial flow, double-rotating type. Each unit is rated at 2500 kw. Under normal conditions, this power plant produces a kw. hr. on the switchboard with approximately 18,000 B.t.u. of fuel.

Below: Consolidated Rock Products Co., Los Angeles, Calif., hauls 10-ton loads in its new six-wheel, Diesel-engined trucks. The hauls are for comparatively short distances



Above: Individual, low-pressure compressor for operation of the Fuller-Kinyon cement pump. On the left is the screw conveyor for separator fines

Several cement mills have recently modernized their power plants. Louisville Cement Co., for example, installed a Westinghouse high pressure 3750-kv. a. turbo-generator to replace three smaller capacity units, one of which directly furnished part of the drive for the clinker grinding tube mills. This new



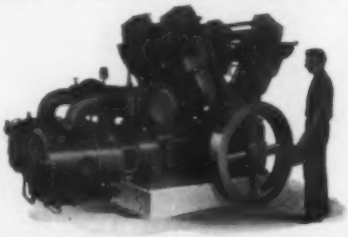
Left: Power for the Gibsonburg Lime Products Co., Gibsonburg, Ohio, is furnished by a 260 hp. National-Superior Diesel which is direct-connected through a Dodge clutch with a 196 kw. Allis-Chalmers generator. Right: All plant operations of the Tuskegee Sand and Gravel Co., Tuskegee, Ala., receive power from a Fairbanks Morse Diesel-electric unit. Plant comprises an 120-hp. Diesel direct-connected to a 96 k.v.a. alternator

unit is an addition to a 1000-kw. Allis-Chalmers and a 2500-kw. General Electric unit.

Several cement plants have put in auxiliary boilers fed by stokers to take care of that portion of waste heat lost in waste-heat boilers caused by shutting down some of the kilns.

Compressor Units

Along with other improvements in power equipment there have been a number of installations of modern air compressor units. While there is a tendency toward the use of the so-called portable air compressor for secondary drilling operations in quarries, the larger quarries and cement plants are continuing to use permanent installations. Typical of these larger compressor installations is the Gardner-Denver RX single-stage, horizontal air compressor which is controlled by a pressure switch wired in series with a magnetic unloader, the compressor running continuously at constant speed. Another example of the larger type is the recent installation of an Ingersoll-Rand type XCB air compressor at the Southern States Portland Cement Co., Rockmart, Ga., plant. This unit is driven through a V-belt by a 150 hp. electric motor and is equipped with two type SCF American air filters. A recent development in Diesel engine-driven compressors is the type XVO Ingersoll-Rand, available in 625-, 935-, and 1250- c.f.m. for 100 lb. sea-level compression. Another interesting application of compressor units is in cement mills where Fuller-Kinyon rotary compressors are located adjacent to the pumps which feed slurry or transport finished cement. The new Argentine cement plant and several installations in this country are typical of this practice.



Ingersoll-Rand heavy duty Diesel engine-driven compressor Type XVO

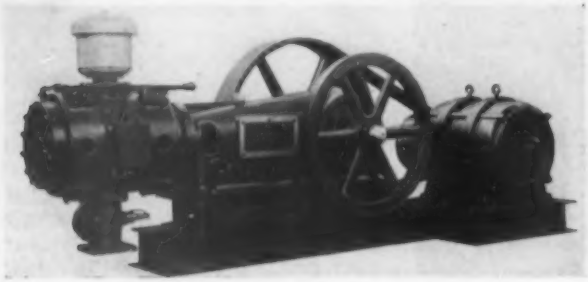
Diesel Engines

Increasing use of the Diesel engine, both as a stationary and as an automotive power unit, is indicated by many new applications in the rock products industry during the past year. The Diesel-electric locomotive for quarry track haulage also has become popular. Typical of these units are the new G. E. 20-ton, 150-hp. Diesel-electric locomotives powered with a Cummins Diesel, model HB-6, placed in service by several large crushed stone and cement companies. Many applications of stationary type Diesel engines are found in sand and gravel, crushed stone, and cement mill power operations. An interesting installation made recently in a Southern sand and gravel plant is the Fairbanks-Morse model 36 E 12, 120-hp., 2-cycle Diesel engine direct-connected to a Fairbanks-Morse 96-kv. a. alternator driven at 360 r.p.m., which develops electricity at 240 volts for all plant power purposes. Excitation is by means of a 5-kw. d.-c. generator driven through a Dodge V-belt. The Diesel is started by compressed air from a compressor driven by a gasoline engine.

A large Eastern operator uses a 5-cyl., 187½-hp. Buckeye Diesel on a ladder dredge to drive a 125-kw., 156-kv. a. generator supplying power for 145½-hp. connected motors. The cost per kw. is ½ cent, depreciating engine on a 10-year basis.

Carthage Crushed Stone Co., Carthage, Mo., has installed a 175-hp. National Superior Diesel engine which is used to operate all the equipment from a drive shaft. This includes: an 8-in. McCully crusher, Jeffrey hammer mill, revolving screens, a Selectro grading screen, a Raymond mill, and several blower fans.

Columbia Quarry Co., St. Louis, Mo., recently announced that it had purchased its sixth Diesel engine, a 225-hp. National-Superior connected to a 150-kw. electric generator. This company has had 3½ years' experience with Diesel operation. For the year ended June 1, 1938, the production of power



Typical of the larger, permanent type compressors in cement and crushed stone plants is the Gardner-Denver RX single-stage unit.

for all five installed Diesel units averaged 13.17 kw. hr. per gallon of fuel oil. Lubricating oil consumption was at the rate of 3070 kw. hr. per gal.

Natural Gas Units

Where natural gas is easily available, engines operating on this fuel have been used. The Braswell Sand and Gravel Co., Inc., Minden, La., for example, employs an 8-cyl. 210-hp. Climax natural gas engine to drive through flat belts an 8-in. Amsco pump and the hoist for both lateral and vertical movement of the suction pipe.

Automotive Diesel

With the rock products industry claiming the distinction of having the largest number of Diesel-engine trucks operated by a single company, much interest has been centered on this form of power. Practically all the larger motor truck companies now manufacture Diesel-engined trucks and in some cases make their own engines. Some of the outstanding characteristics of these units are low fuel consumption, smooth operation, excellent idling ability and freedom from overheating and loss of power when subject to heavy loads since the engine depends upon heat for combustion.

Not only are new Diesel trucks being purchased, but there have been many cases where companies have converted their gasoline engined trucks to Diesel engine operation. Newer type Diesel engines have largely overcome the objectionable odor that characterized these units, and the weight per unit of horsepower now compares favorably with gasoline engines.

Among the truck manufacturers providing their own Diesel engines are General Motors, Dodge and Mack-International Motor Truck Co., with their new Mack-Lanova 6-cyl. engine which develops 131 hp. at 2000 r.p.m and operates on a four-stroke cycle.

The Consolidated Rock Products Co., Los Angeles, Calif., is operating six Diamond T trucks equipped with Hercules Diesels and are hauling from 6 to 7 tons of payload on 4-wheel and 10 tons on six-wheel trucks. The 4-wheel units with a 6-ton pay load operate on an average at 11 miles to the gallon of fuel oil.

Largest Diesel Truck Operator

Colonial Sand & Stone Co., N. Y., N. Y., during the past year became probably the largest operator of Diesel-powered trucks in the country when it purchased a new fleet of Mack trucks with Cummins Diesel engines and Dieselized some of its older equipment.

In November, 177 Diesel-powered trucks were in operation and the number will be increased to 260 early in 1939 to handle ready-mixed concrete, aged lime putty and mortar and aggregates.

The company operates producing plants on Long Island and handles deliveries of aggregates in New York City, Westchester County and Connecticut from 20 docks and loading terminals.

Fuel Consumption Cut Nearly Half

At present schedules, 36,000 tons of aggregates are handled and delivered daily with haulage distances ranging from 6 to 40 miles. The Cummins Diesels are 4- and 6-cyl., and 23 of the newer trucks have Mack Diesel engines. Capacities of the bodies on the newest trucks, which are dumped by Wood or Heil telescoping hydraulic hoists, are 14- and 16-cu. yd., the latter being 6-wheel trucks.

Speed Up Deliveries with Diesel Equipment

Experience with the trucks has been highly satisfactory, according to company officials. The gallonage of No. 2 Diesel fuel oil is but 50 percent of the gasoline formerly used and of course it costs less.

Deliveries have been speeded up from about 28 to 32 m.p.h., and the engines have a greater horsepower rating than those operated by gasoline. The conversion of the older trucks to Diesel power was simple and involved only the change of sprockets.

Maintenance costs are not now available as sufficient time has not elapsed for this data to be accumulated, but a definite procedure has been developed for servicing and checking each truck to reduce maintenance costs and prolong the life of the trucks.

Fourteen garages are provided in the city and the company's skilled mechanics, who have had many years' experience in automotive work, have been trained to work on Diesel engines.

Above: Part of fleet of Diesel-powered trucks lined up for loading at the Astoria, L. I., bins of the Colonial Sand and Stone Co., Inc.

Below: Close-up of two of the aggregate trucks powered by Diesel engine.

Applying Dust Control In New Ways

By BROR NORDBERG

Dust prevention and dust control measures continue to be of greater importance in practically all branches of the rock products industries. Reasons for installations of dust collecting equipment are mainly to improve plant working conditions but often to recover valuable "dusts" which can then be reprocessed through the plant, or which can be sold as a by-product.

Dust control measures are most highly developed in the portland cement industry, where the majority of plants have made some provisions for it, and in various other plants where a siliceous rock is being processed and a hazard to health is known to exist.

The recently rebuilt Hudson, N. Y., plant of the Universal Atlas Cement Co. is a good example of a cement mill that is kept exceptionally free from dust. The mill has been rebuilt with new-type, tight equipment from which very little dust can escape, and dust arrestors are used at all points where dust is not confined. A negative pressure is maintained in each of the grinding circuits and unit pressure suppressors are stationed at the end of transport lines, etc. Dusts collected in various departments are returned into the circuits from which they originate.

Stack Dust Recovery

Medusa Portland Cement Co., at Wampum, Penn., has placed in operation stack dust collectors which are the first of that type installed in an American cement mill. The collector for each kiln consists of a nest of four 36-in. cyclones into which the dust-laden exhaust gases from the fuel economizers are split by vertical vanes.

Dust is precipitated from each set of four cyclones into a small hopper. The hoppers in turn discharge automatically into a screw conveyor. This common, enclosed screw conveyor discharges into a bucket elevator and the dust is placed in a large flue dust bin. Recovery of dust is about 880 lb. per hour with a collection efficiency slightly more than 84 percent, according to tests by the dust-collector manufacturer.

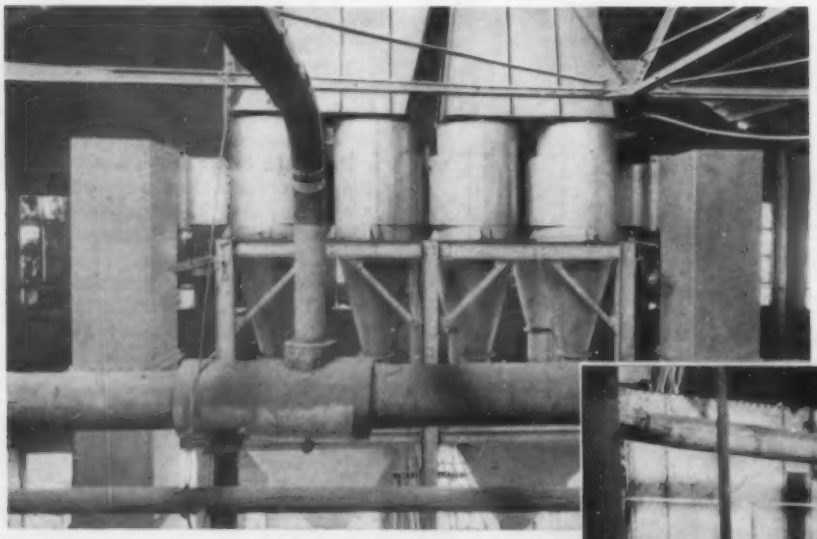
Collection equipment in portland cement plants serves other purposes and often, in addition to collecting dust, is an important aid to efficient operation of other equipment. A good illustration is the Bay Bridge, Ohio, plant of the Medusa Portland Cement Co., where cloth-type collectors are operated in conjunction with grinding.

An installation of air separators had been made, with the discharge of fines going directly into a collecting screw conveyor on the mill floor. Performance of the air separators was disturbed because of air pressures built up within them due to the relation of the screw conveyor flights to the separator discharge. By joining dust collector piping into the screw conveyor housing to a dust collector the condition was relieved and the air separator performance was stabilized.

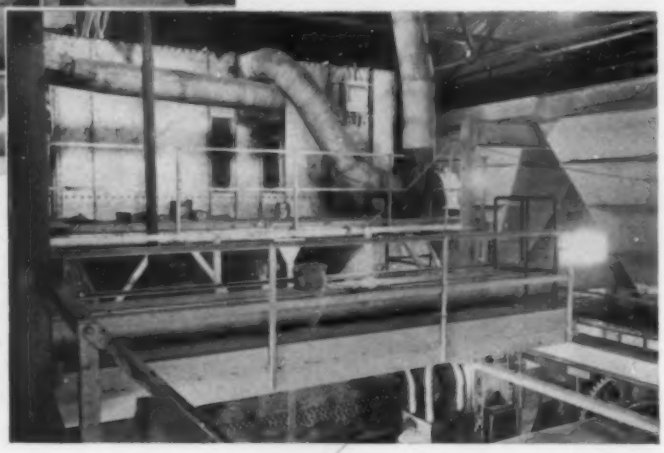
Collecting Coal Dust

The Kosmos Portland Cement Co. is using a wet-type collector in an unusual way to catch coal dust escaping in the coal crushing department. Coal is reclaimed from storage by a belt conveyor which discharges into a hammer mill coal crusher. The discharge from the mill (minus ½ in.) is elevated by a chain bucket elevator to a screw conveyor which fills six coal mill feed bins.

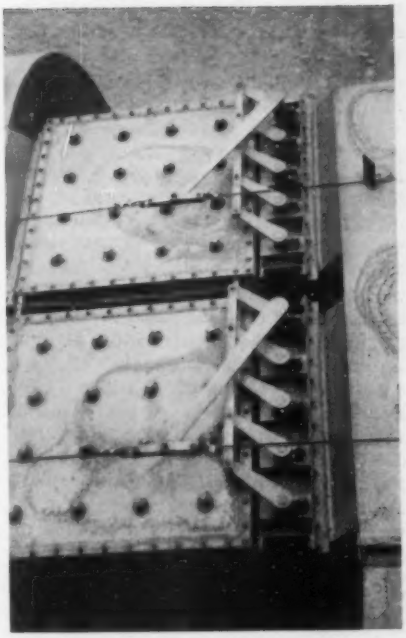
The dust collector is operated to collect dust generated from the belt discharge into the mill and in the bucket elevator. Air heated to 250 deg. F. is drawn through the boot of the elevator from the clinker pan conveyor beneath the kiln firing floor. This arrangement serves the double purpose of partially drying the coal and keeping it from



Above: New-type stack dust collector installed by Medusa Portland Cement Co. at Wampum, Penn. A group of four cyclones, for each kiln, discharge into a hopper and the dust is conveyed to a flue dust bin



Right: New cloth-type, automatic discharge collector in finish mill of Medusa's plant at Bay Bridge, Ohio. The collector ducts are arranged to relieve pressures built up in the air separators and thereby contribute toward a more uniform product



Looking down on the top of a "Multiclone" dust collector; this installation is used by Spokane Portland Cement Co. on raw material

gumming up the elevator buckets and the screw conveyors feeding into the overhead mill feed bins. Precipitated dust is returned into the coal mill with the fresh feed. The dust collector is 99.5 percent efficient in removing all the coal dust from the air.

The United States Lime Products Co., Sonora, Calif., has installed a "Multiclone" dust collector on a 6- x 120-ft. rotary lime kiln, which is the first installation of this type in a lime plant. The collector also serves as a source of induced draft and displaces a large steel stack.

A test run of the kiln showed, with a production of 40.83 tons of lime in 24 hr., a recovery of 1.173 tons of dust. By its installation fuel costs have been reduced more than sufficient to offset the power consumed by the collector. Efficiency of the dust collection is estimated to be at least 95 percent, with 100 percent minus 65-mesh and 85 percent through 325-mesh.

The dust collection unit consists of twenty-five 9-in. tubes. In operation, the kiln gases enter the battery of tubes in the dust collector and are forced against a series of radial vanes. The vanes give to the gases a rapid swirling motion that increases as the gases descend to the narrowed outlet at the bottom where the dust is deposited.

Huron Portland Cement Co., Detroit, Mich., has devised an effective method of dust control in the bag house, ordinarily one of the most difficult parts of a mill to keep clean. Improvised sorting tables are used ahead of the bag cleaner to catch dust before it can possibly escape into the room.

The sorting tables have perforated plate for table tops, a hopper and an exhaust leading to a dust collector on the floor below. The velocity of the exhaust at the table top is 300 to 400-ft. per minute which increases when part of the holes are covered by bags. Similarly, in the bag repair room, the sewing machines are equipped with a perforated top in the area on which the bag rests while being sewed. A narrow slot is also provided under the table top so that a curtain of fresh air is continuously drawn past the operator's face.

Commercial producers of non-siliceous crushed stone aggregates have also given some attention to the problem of dust, particularly in New York state where a state code is already in effect. Producers, through their state association, have taken a coöperative attitude toward the pending regulations and have expressed themselves as willing to support a movement directed toward improving working and health conditions.

The cyclone-type of dust collector is being more generally used in crushed stone plants. The dust, if limestone, is generally sold to farmers, or it can be often merchandised for rock dusting of coal mines and for other purposes. A rather unique installation of a collector of this type was recently completed in a Pennsylvania plant. This producer installed a revolving cylindrical drum through which stone is passed and subjected to a series of impacts to break down friable material. The drum is open at the discharge end and is air-swept toward the feed end, dust being precipitated in a cyclone collector.

The new T.V.A. aggregates plant, designed to produce crushed stone for use in the construction of Hiwassee dam, has some dust control features that are, and could be, adaptable to commercial plants producing siliceous stone.

Aggregates are being produced from a rock deposit containing 65 percent quartz. Drilling is done wet, with the introduction of water directly into well drill holes and in holes drilled by jackhammers. The primary crusher discharge to a belt conveyor is enclosed and dust is pulled through a duct to an individual dust collector.

Screening is done dry in a completely enclosed building. Dust concentrations are heaviest at this point. Inside the building, the vibrating screens are completely enclosed within a tight-fitting framework and a duct leads to a collector outside the enclosure.

Still Newer Developments

During the past year there have been several new types of dust collectors developed. One of these, a mobile dust collector unit, has been installed in a plant to handle the dust problem on tripper belt discharges serving a number of bins. The collector consists of a combination of a "Multiclone" followed by bag filters, the whole arrangement being built on a car which moves with a tripper. The arrangement is to take dust from ahead of the tripper and also vent the bin. The collected dust is discharged continuously and automatically back into the particular bin so that the various materials can be run over a belt into different bins without danger of contamination.

At Hiwassee dam, the primary crusher is housed at its point of discharge to a belt conveyor to confine dust. The duct shown leads to an individual dust collector

Magnetic Separation For Industrial Minerals

By RAYMOND B. LADOO*

Removing iron and other highly magnetic substances from ores, minerals, and chemicals by the use of magnetism has been practiced for nearly a hundred years, a process for magnetically separating iron minerals having been granted in England as early as 1792.[1] Hundreds of patents on this subject have been granted over a period of many years in all of the principal countries of the world. Most of the commercial applications of this principle, however, until recent years have been for the recovery of magnetite or other iron bearing ores, or for the removal of tramp iron from crusher feed. In the treatment of iron ores and similar problems the valuable and usually larger portion of the ore has been magnetic and the waste and lesser portion has been non-magnetic. There are, of course, some exceptions to this; for example, the treatment of black sands to recover monazite.

Until very recent years magnetic separation has not been practiced on an important scale in the non-metallic mineral industries. Yet it is interesting to note that one of the earliest commercial uses of this process was for the separation of magnetite from apatite in New York State in 1852. Even today most producers of non-metallic minerals are unfamiliar with magnetic separation and have never considered the process as a possible working tool in solving any of their production problems.

There are several reasons for this situation. One is that, until recent years, the prices of most non-metallic minerals were so low that processes of beneficiation were not considered economically feasible. Consumer specifications were not nearly as rigid as they are today and there was little need or incentive to attempt to make better products. Another reason was that magnetic separators had not been specifically designed for removing small amounts of magnetic impurities, especially if they were rather feebly magnetic. There was little demand for this type of separation, but, as is usually the case, when the need arose equipment was quickly developed to satisfy the need. Exceptions to this general statement should be noted, however. As long as 30 years ago, with the comparatively inefficient separators then available, Gunther[1] in 1909, records the separation of such feebly magnetic minerals as monazite, garnet and hornblende. In 1915 Kithil[2] described in detail the separation of feebly magnetic garnet, epidote, apatite, olivene, and tourmaline from still more feebly magnetic monozite, and of both groups from "non-magnetic" quartz and feldspar.

It is probably not as widely known as it should be that the iron content of certain minerals can be reduced as low as 0.05% Fe_2O_3 or lower even when the iron was originally present in the ore in the form of a very feebly magnetic mineral. It is now possible to remove iron magnetically and in a dry state from many minerals and chemical products which, not so many years ago, would have been considered removable only by acid bleaching. Mineral impurities which have, in the past, generally been considered non-magnetic are now being removed by high intensity magnetic separators.

What Are Magnetic Minerals?

All minerals, if exposed to sufficiently strong magnetic influence, exhibit some magnetic susceptibility, even such "non-magnetic" minerals as quartz and feldspar, although some are so very feebly magnetic that their removal magnetically is not possible with equipment so far developed. Even oxygen gas is magnetic; liquid air is attracted and held by a magnet. Very feeble magnetic susceptibility is apparently a physical property not dependent upon any iron content. But, from a practical standpoint, all minerals which can be removed magnetically contain some iron, though the amount need not be large. Magnetic suceptibility is not at all proportional to the iron content, a fact which greatly surprises most people. For example, if the attractive force of pure iron is taken as 100, magnetite (Fe_3O_4) with a theoretical iron content of 72.4% has a magnetic force of 40.18, while hematite (Fe_2O_3) with an iron content of 70.0% has a magnetic force of only 1.32. Pyrite (FeS_2) has an iron content of 46.6% and a magnetic force of 0.23, while limonite with an iron content of 59.8% has a magnetic force of 0.84. Biotite mica with a widely varying iron content of say from 6.5% to 22% is lifted by a magnet with comparative ease and has been ascribed an attractive force of 3.2. It has, on an average, only a third as much iron as pyrite, but has a magnetic attraction 14 times as great. Muscovite mica with a metallic iron content as low as 1.5% is now being removed magnetically.

The iron content in a mineral may occur in any one or all of several different forms. For example, let us take a crude feldspar and assume that analysis shows that it contains 2% of iron expressed as Fe_2O_3. That iron may be present, (1) as grains of the pure iron oxide, magnetite; (2) as part of the composition of grains of such iron bearing minerals as garnet, biotite, hornblende, etc.; (3) as an iron rust stain (limonite) on the feldspar cleavage planes; (4) it may be as minute microscopic veinlets of some iron bearing mineral within apparently solid grains of feldspar; or (5) it may be almost molecularly dispersed in the feldspar molecule. The method of occurrence of the iron impurity in the feldspar is perhaps more important than the amount present. If it occurs as fairly large (say 80 mesh or coarser) grains of iron oxide or even in feebly magnetic minerals in separate grains of similar size the chances are very much better that the iron content can be greatly lowered by magnetic separation than if the iron is uniformly disseminated in microscopic grains or stains throughout the feldspar. In the latter case magnetic separation may be impossible.

Still another condition arises where two presumably non-magnetic minerals, such as say barite and calcite, may still be separated magnetically. If one of the minerals contains inclusions of a magnetic mineral and the other does

Fig. 1: Principle of operation of a high intensity magnetic pulley for belt conveyors

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not, magnetic separation may perhaps be successfully applied.

It is quite possible and even probable that many conditions exist today where high intensity magnetic separation could be profitably applied but where producers have never even considered the possibility of the application of this process to their problems. Just because a rock does not contain visible grains of a known highly magnetic mineral is no reason that a magnetic separation could not be made. If a complete and accurate chemical analysis shows the presence of appreciable amounts of iron there is at least a possibility that magnetic separation might be used, even to separate quartz from feldspar or graphite from calcite.

The only way to determine whether or not minerals may be separated magnetically is to have a test run made by a company which makes modern, high intensity magnetic separators.

The following table, taken from a longer table by Davis,[3] shows some of the minerals which have shown sufficient magnetic susceptibility to be removed successfully by magnetic separation.

TABLE I.

	Substance	Relative Attractability
Strongly magnetic	Iron (taken as standard)	100.00
	Magnetite	40.18
	Franklinite	35.38
	Ilmenite	24.70
Weakly magnetic	Pyrrhotite	6.69
	Siderite	1.82
	Hematite	1.32
	Zircon	1.01
	Limonite	0.84
	Corundum	0.83
	Pyrolusite	0.71
	Manganite	0.52
	Calamine	0.51

In the preceding table the definite figures for relative attractibility must be used with much caution, especially in the weakly magnetic group. The relative attractibility of minerals depends upon purity, physical structure and other characteristics. An iron bearing corundum, for example, might be much higher than 0.83 and a chemically pure corundum might be somewhat lower than that figure.

In addition to the minerals in the above table the following minerals have been successfully removed by magnetic separation: biotite mica, muscovite mica, leucite, monazite, garnet (iron bearing), wolframite, rhodonite, burnt magnesite, hornblende, rutile, chromite, iron rust coated grains of silica and other "non-magnetic" minerals. Rock shale is being separated from borax in a dry state, where formerly it was necessary to dissolve it in water, filter, evaporate, crystallize and dry to remove the shale impurities.

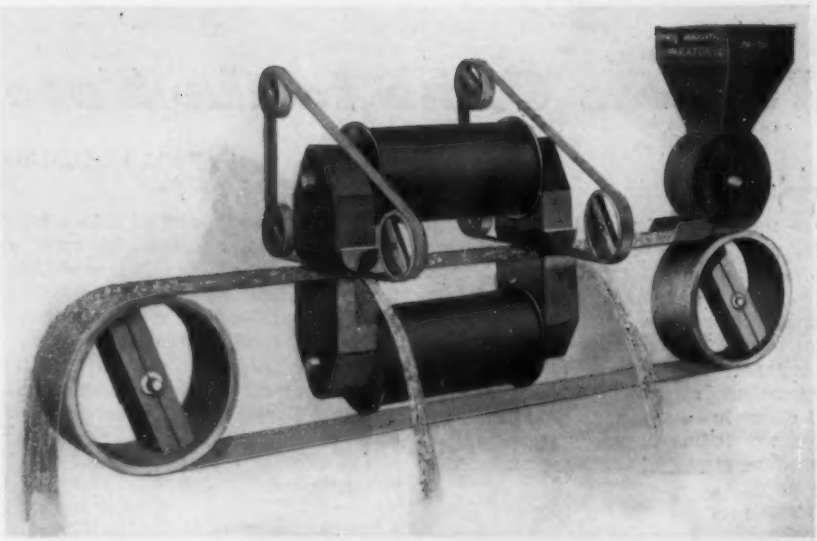


Fig. 2: Belt type separator which is known as the selective or lifting type as contrasted with the induction or deflection type

Other factors which, in practice, influence "magnetic removability" are specific gravity and the size and shape of the magnetic mineral particles. If a tiny grain of a highly magnetic mineral, such as magnetite, is attached to or imbedded in a larger "non-magnetic" grain, the whole grain will probably be removed. But if that tiny attached or included particle is very weakly magnetic, and particularly if the "non-magnetic" mineral grain is large and heavy, the magnetic force may not be sufficient to remove the grain and it will go into the finished product.

Principles of High Intensity Magnetic Separation

The operation of the ordinary magnetic head pulley on conveyors, to remove tramp iron, is familiar to most readers of ROCK PRODUCTS. It consists of an iron pulley containing a series of electro-magnets, energized from a slip ring on the pulley shaft. Iron and very highly magnetic substances, such as magnetite, cling to the conveyor belt as long as it is in contact with the pulley, and then drop clear of the ore stream. Such pulleys are rarely used as magnetic separators, but where the ore contains magnetite considerable is removed by the pulley incidental to taking out tramp iron, thus relieving the load on the subsequent separators. The principal of operation is shown in Fig. 1.

The Wetherill-Rowand type of separator has been in use for many years and is still preferred by some engineers for certain minerals. It is known as the selective or lifting type as contrasted with the induction or deflection type to be described later. This consists essentially of an ordinary belt conveyor which carries the ore to be treated, and above it, running at right angles to it, a series of cross belts. See Fig. 2. In the zone over the main conveyor belt, stationary electro-magnets are placed between the upper and lower parts of the cross belts. The under surfaces of the cross belts are set down close enough to the moving surface of the ore on the main belt, so that magnetic grains are lifted and held to the under surfaces of the cross belts, while in the magnetic zone of the stationary magnets. As soon as that portion of the cross belts carrying the magnetic grains moves beyond the magnetic zone their load is dropped. The magnets between the cross belts vary in intensity, the first being the weakest and the last the strongest. In this way the most highly magnetic, and thus most easily influenced, grains are lifted out and removed by the first cross belt. Each succeeding belt removes weaker and weaker magnetic material. The ore remaining on the main conveyor belt at the end of its run is presumably free of magnetic material.

Since the magnetic grains have to be lifted against gravity it is obvious that this machine is, in general, better adapted to removing the more highly magnetic minerals. While it has a lower capacity and higher cost than the induction type of separator it has an advantage in selectivity. Where an ore contains several valuable minerals of varying magnetic susceptibility each can be saved separately by the use of this machine.

(To be continued)

[1] Gunther, C. G., Electro-Magnetic Ore Separation, New York 1909, p. 5, also 18-20.
[2] Kithil, K. L., U. S. Bureau of Mines, Tech. Paper 110, 1915.
[3] Bul.7, Minnesota School of Mines.

Feeders Come to the Fore

By BROR NORDBERG

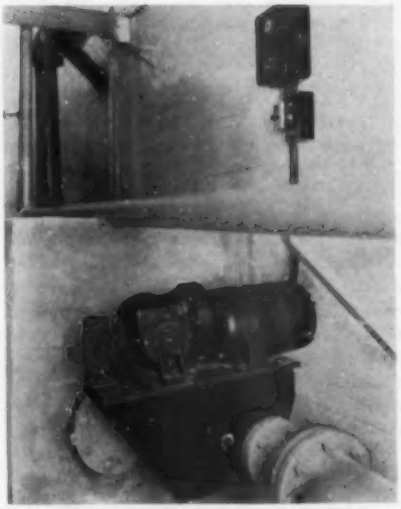
Proper feed of materials to grinding kilns, dryers, mills, crushers, vibrating screens and a uniform flow of materials from bins and hoppers and through chutes into other equipment have a lot to do with operating efficiency. The need for uniformity of feed in many operations has always been there but it either has gone unrecognized in past years or it has been only recently that effective means of obtaining uniformity were developed.

The portland cement industry must rely for efficiency and product uniformity in grinding upon proper methods of feeding mills, particularly in closed-circuit grinding. With grinding representing so large a percentage of the total cost of manufacturing cement, it is necessary to get the proper rate of feed into a mill to approach the optimum output without exceeding it. Also, in closed-circuit grinding it is desirable to have an accurate measure of control of feed to maintain the circulating loads upon which capacity depends. In fact, proper feed is the essence of proper grinding.

In getting a proper feed into a mill, it is not always enough to have a type of feeder that is capable of putting the correct amount of feed into the mill. It is just as important to get a uniform supply of material to the feeder—otherwise its efficiency is wasted. This is usually concerned with proper design of bins and hoppers or aids to facilitate their discharge to the feeder. A few typical modern feeder installations will be mentioned.

Vibrating Feeders

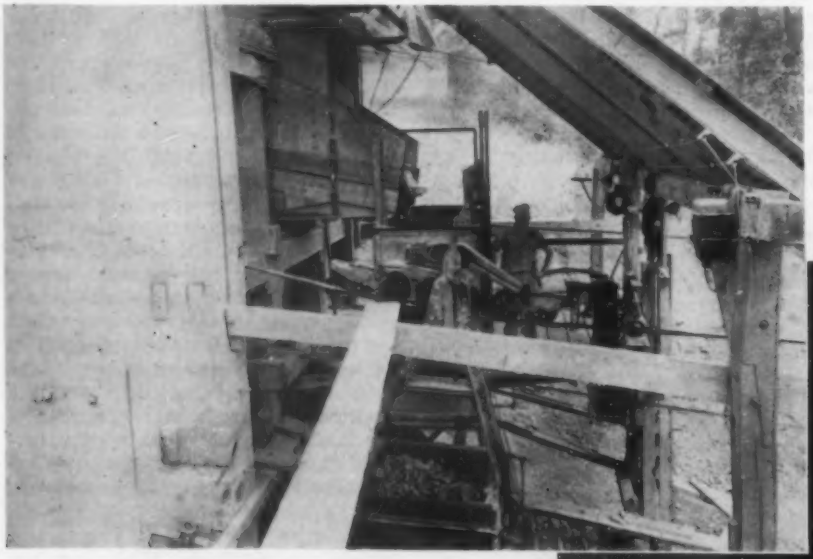
An Eastern portland cement plant is effectively utilizing vibration as its means of feeding materials into final grinding mills. The accompanying illustration shows how Syntron "Vibra-Flow" feeder conveyors, in this case, are used to make clinker, slag and gypsum flow at controlled rates into the grinding mill. A controller converts alternating current into pulsations which move the feeder trough by electro-magnetic vibration. The rate of flow of the materials through the separate troughs is controlled electrically and is varied by a twist of a dial rheostat in the controller. Incidentally the hoppers above are equipped with small vibrators of the same make to facilitate the supply of material to the feeders.



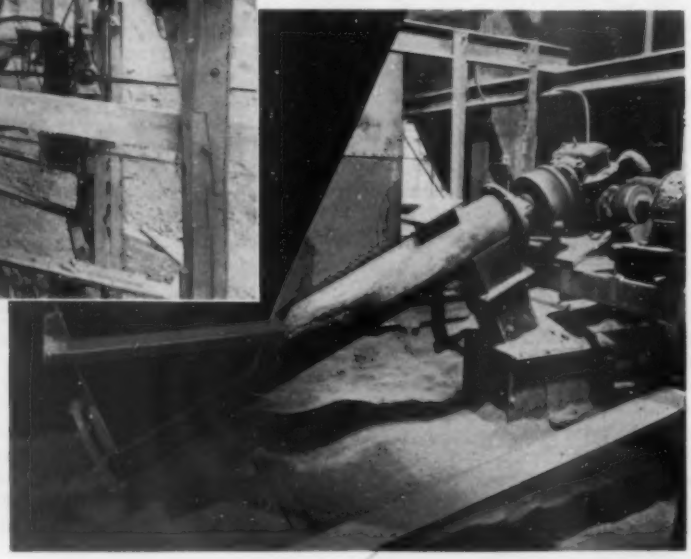
Slurry valve developed by the Fuller Co., as a safety device against operating failures. The valve operates in an emergency, through a plunger device, to cut off the flow of slurry and prevents overflowing. The valve is operated by a.-c. or d.-c. current or compressed air and has a remote and/or automatic control

Aerated Kiln Feed

At Wampum, Penn., Medusa Portland Cement Co. engineers have installed a method of kiln feed designed to eliminate surges and flooding which in many plants is the cause of improper burning of clinker. The feed into each kiln is from a small open-top hopper into a "dog-leg" or inclined screw conveyor. The theory of the feed arrangement is to have a uniformly aerated material in each hopper which will flow uniformly into the "dog-leg" feeder.



Above: Application of vibrating feeder to discharge mine run stone from a 100-ton bin into tramway buckets at a midwestern cement plant. Stone is delivered with precision into the crushing plant



Right: Inclined screw conveyor, or "dog-leg," feeding one of the kilns at Medusa's Wampum, Penn., plant. Open top hoppers deliver an aerated material to the feeder

Raw material is released from the blending bins by roll feeders driven from a common line shaft by a variable speed motor and is carried by screw conveyor to a bucket elevator which discharges into another overhead screw conveyor. This conveyor has a span over the top of all four kiln feed hoppers. The blending bin feeders are so regulated that the feed is equal to or greater than the feed input into the kilns. The bottom of the conveyor box is open over the feed hoppers, which are always kept full, and the excess feed returns to the bucket elevator through a return screw conveyor. By having a circulating flow of feed material into the small hoppers, the material is "alive" and the hoppers empty completely into the inclined feeders. A rheostat is connected in circuit with the motor drives of the feed elevator, hopper conveyor and return conveyor to regulate the flow of material through the system. An excessive amperage in the circuit indicates an overload in the return conveyor and stops the blending bin feeders. When the overload is relieved, the feeders automatically start again. An identical system is used to feed the raw material into tube mills.

Variable Speed Drives

Nazareth Cement Co., Nazareth, Penn., uses a Link-Belt PIV drive to control the rate of travel of a trunnion screw and therefore the rate of feed of clinker into a tube mill. The gear drive is reset at pre-determined points to vary the feed as a control of fineness of the mill discharge for open circuit and closed circuit grinding.

At Hudson, N. Y., the Universal Atlas Cement Co., the feed of raw material into the raw grinding mill circuit is at an electrically controlled rate. This circuit consists of three B & W mills each closed-circuited with air separators and bucket elevators. Recording weight feeders are used to proportion stone and shale into the bucket elevator. Should the pulverizing mill, which receives as feed rejects from the air separator, be overloaded, the rate of fresh feed is automatically reduced to one-half by a system of relays when the elevator amperage indicates an overload. The recording weight feeders are interlocked mechanically in pairs with each pair driven by a 10-hp. 1200-600 r.p.m. motor. The extent of the circulating load (kept at about 1200 percent) is measured by the elevator motor amperage.

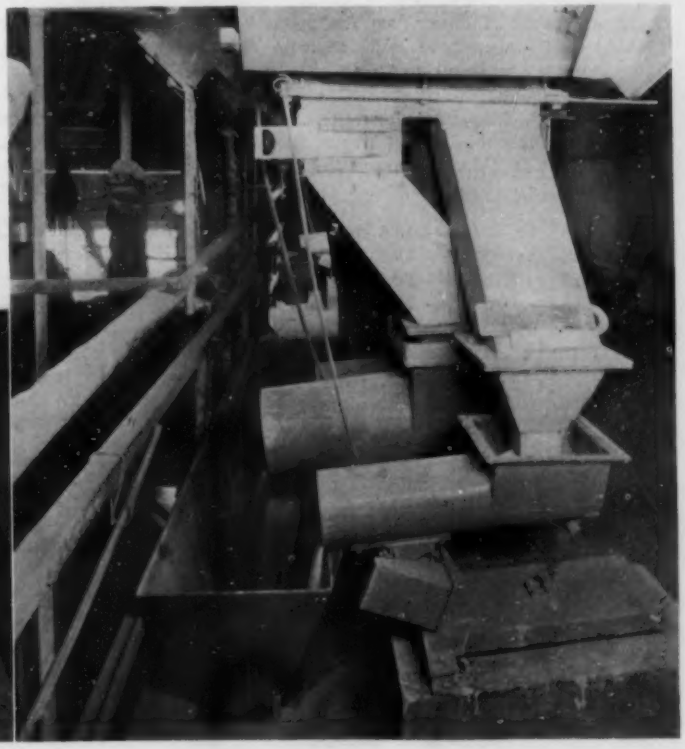
Santa Cruz Portland Cement Co., Davenport, Calif., has a simple but effective device for feeding dry raw materials to a kiln. Feed is from a hopper into a screw conveyor turning inside a straight cast iron pipe. The screw flights stop about a foot short of the end of the pipe inside the kiln. The diameter of the pipe fills up with material ahead of the screw and protects it from excessive heat.

Another instance of modern feeder practice, this time to regulate the rate of feed of pit-run material to a screening plant, is the Roscoe, Calif., plant of John D. Gregg. One 800-ton surge hopper and variable-speed conveyor feeder are used to bring to the plant over a belt conveyor the desired tonnage of material that can be handled by the plant. The installation was designed by The Conveyor Co., Los Angeles, Calif., and comprises a Sterling "Speed-Trol" power unit on a special short belt feeder located near the excavation. An electric remote speed control and indicator located over 500 ft. from the plant enables the operator to control the speed of the small feeder conveyor to conform with plant requirements. The power unit, controlled from a remote location, consists essentially of a V-belt drive over two pulleys. In changing the speed, the diameters of both pulleys change automatically and the belt tension is retained.

Vibrating feeders and auxiliary vibrators are finding increased applications in the industry. A typical installation of the former (illustrated) shows the use of a Jeffrey-Traylor vibrating feeder in a cement plant to feed mine run stone from a bin to tramway buckets for delivery to a stone crusher.

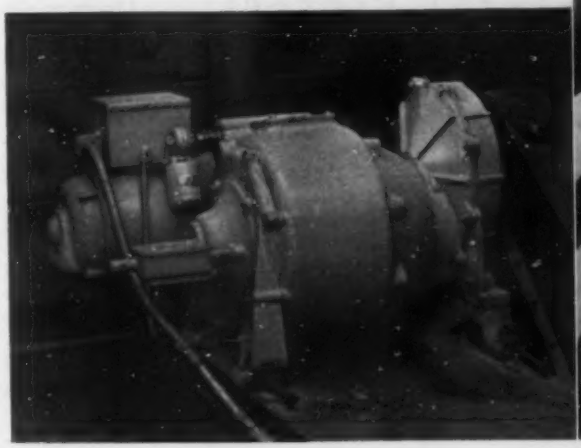
Use of Vibrators

Small electrical vibrators that can be readily attached to bins, hoppers, and chutes have a number of applications. These units are being used to advantage to flow fine materials from bins, which with coarser material gave no trouble; to move materials through inclined chutes which without assistance are too flat to produce a positive flow; to flow damp materials through hoppers on to conveyor belts and for many other purposes.



Right: Feeder conveyors feeding clinker, slag and gypsum into a cement grinding mill by electro-magnetic vibration.

Below: Power unit driving conveyor feeder in a California plant to regulate discharge of pit run material from a surge bin to a belt conveyor. Rate of feed is varied by remote electrical control



Estimation of Phase Composition of Cement Clinker

Part 5

Liquids in mixtures of types A-2 and C-2 follow the C_3S-C_3A surface to the quintuple line T_1D. While on that surface, the C_4AF/C_2S ratio is the same in mixture and liquid. The composition of the liquid when it arrives at the line T_1D is found by locating a point on the line at which the liquid has the same C_4AF/C_2S ratio as in the mixture under consideration. This may be accomplished by referring to Fig. 18, which gives the composition of liquids on T_1D for any given C_4AF/C_2S ratio.

As an example, let us consider a mixture, N, with the composition 75 percent C_3S, 5 percent C_2S, 13.75 percent C_3A, 6.25 percent C_4AF. The composition of the projection of this mixture from the C_3S point to the C_2S-C_3A-C_4AF plane is 20 percent C_2S, 55 percent C_3A, 25 percent C_4AF. Locating this composition in Fig. 12, it is found to be of type A-2. Thus it is known that Fig. 18 is applicable to mixture N. The C_4AF/C_2S ratio in N is 1.25. Referring to Fig. 18, it is found that when the liquid arrives at T_1D, at some temperature between 1341 deg. C. and 1470 deg. C., the liquid has the composition, —13% C_3S, 27.5 percent C_2S, 50 percent C_3A, 35 percent C_4AF. The phase composition of N, at the temperature at which the liquid arrives at T_1D, may be estimated as follows:

$$C_3S = 75.0 + 13.0\ m$$
$$C_2S = 5.0 - 27.5\ m$$
$$C_3A = 13.75 - 50.0\ m$$
$$C_4AF = 6.25 - 35.0\ m$$

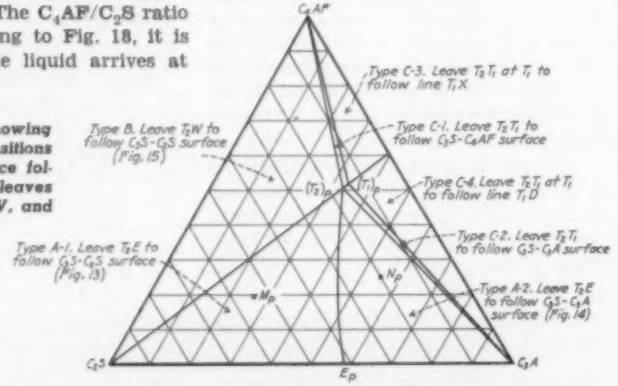

C_4AF
Type C-3. Leave T_2T_1 at T_1 to follow line T_1X
Type B. Leave T_2W to follow C_2S-C_3S surface (Fig. 15)
Type C-1. Leave T_2T_1 to follow C_3S-C_4AF surface
Type C-4. Leave T_2T_1 at T_1 to follow line T_1D
Type C-2. Leave T_2T_1 to follow C_3S-C_3A surface
Type A-1. Leave T_2E to follow C_2S-C_3S surface (Fig. 13)
Type A-2. Leave T_2E to follow C_3S-C_3A surface (Fig. 14)
C_2S
C_3A
E_D

Fig. 12 — Diagram showing classification of compositions with reference to surface followed when liquid leaves quintuple lines T_2E, T_2W, and T_2T_1

In applying principle 2 to the evaluation of m, the sums of the percentages of C_4AF and C_2S are used, since these are the absent phases. That is, $m = (5.0 + 6.25)/(27.5 + 35.0) = 11.25/62.5 = 0.180$. Substituting in the equations, the phase composition is found to be 77.3 percent C_3S, 4.7 percent C_3A, 18.0 percent liquid.

Liquids in type C-4 mixtures arrive at the line T_1D at T_1. Fig. 18 is consequently not needed for estimating the composition of the liquid when it arrives at the quintuple line T_1D, since in every case it is 3.7 percent C_3S, 13.8 percent C_2S, 32.3 percent C_3A, 50.2 percent C_4AF.

When Liquid Leaves Quintuple Line T_1D (Types A-2, C-2 and C-4)

Liquids in mixtures of types A-2 and C-2 leave the quintuple line T_1D to follow the CaO-C_3S surface. Liquids of type C-4 may leave the line T_1D to follow the CaO-C_3S or CaO-C_3A surface. Those which follow the latter surface are not encountered in mixtures of portland cement composition and will not be considered. It is necessary then, to consider only the conditions governing the point at which the liquid leaves T_1D to follow the CaO-C_3S surface, for the three types, A-2, C-2 and C-4.

As the liquid follows T_1D, three solid phases are present, CaO, C_3S and C_3A. The C_3A is decreasing, however, and a point is finally reached at which it disappears, and only CaO and C_3S remain.

It has been found previously that when the liquid arrives at T_1D, no solid CaO is present. However, as the temperature is raised, and the liquid changes in composition along T_1D, solid CaO (free CaO) appears. At the same time the proportion of C_3A decreases, until finally this solid phase disappears. The solid phases present are then CaO and C_3S, and the liquid will leave T_1D to follow the CaO-C_3S surface. This occurs when the C_4AF/C_3A ratio in the liquid is identical with that of the mixture. Applying principle 4 as a preliminary step in the estimation of phase composition, it is seen that the compositions of mixture and liquid must be expressed in terms of four components, two of which are CaO and C_3S. This condition is not fulfilled when composition is expressed in terms of C_3S, C_2S, C_3A and C_4AF, as in the previous examples. It is consequently necessary to depart from this scheme. Instead, the components of the adjacent system CaO-C_3S-C_3A-C_4AF are used in expressing compositions of mixture and liquid. Fig. 19, which may be used to obtain the composition of the liquid when leaving T_1D to follow the CaO-C_3S surface, is consequently designed to give the composition in these terms. Before applying this figure to the estimation of phase composition it is necessary, however, to express the composition of the mixture in terms of percentages of CaO, C_3S, C_3A and C_4AF. Methods of transforming compositions into these terms are described below.

If the oxide composition of the mix-

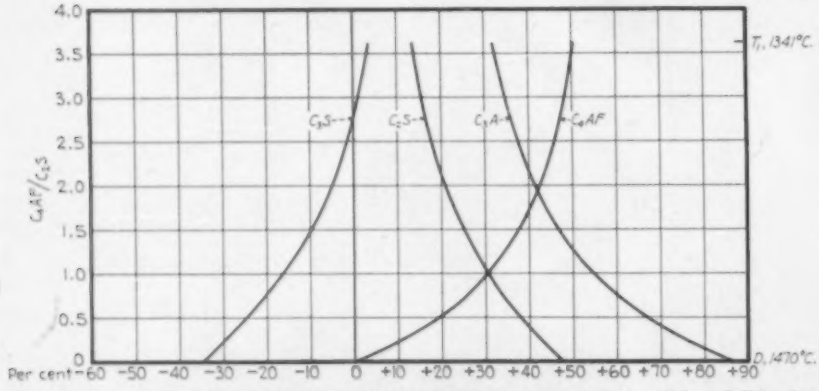


Fig. 18—Diagram for determining composition of liquid in mixtures of type A-2 and C-2 when arriving on quintuple line T_1D and C_3S-C_3A surface

In the System $3CaO.SiO_2$-$2CaO.SiO_2$-$3CaO.Al_2O_3$-$4CaO.Al_2O_3.Fe_2O_3$ at Clinkering Temperatures

By L. A. DAHL

Research Chemist, Portland Cement Association, Chicago, Ill.

ture under consideration is available, the composition may be substituted in Equations 6 to 9 inclusive. On the other hand, if the composition has already been converted into terms of C_3S, C_2S, C_3A and C_4AF, a more simple method may be employed. Let $(C_3S)_1$, $(C_2S)_1$, $(C_3A)_1$ and $(C_4AF)_1$ represent percentages of these components, and let $(CaO)_2$, $(C_3S)_2$, $(C_3A)_2$, and $(C_4AF)_2$ represent the transformed composition. Then,

$$(CaO)_2 = -0.3256(C_2S)_1 \quad \ldots\ldots(18)$$

$$(C_3S)_2 = (C_3S)_1 + (C_2S)_1 - (CaO)_2 \quad \ldots\ldots(19)$$

$$(C_3A)_2 = (C_3A)_1 \quad \ldots\ldots(20)$$

$$(C_4AF)_2 = (C_4AF)_1 \quad \ldots\ldots(21)$$

For example, mixture N, previously considered, has the composition, 75.0 percent C_3S, 5.0 percent C_2S, 13.75 percent C_3A, 6.25 percent C_4AF. The transformed composition, obtained by applying Equations 18 to 21, is —1.6 percent CaO, 81.6 percent C_3S, 13.75 percent C_3A, 6.25 percent C_4AF. The negative percentage of CaO appears absurd, but the values obtained may be used in the estimation of phase composition in the same manner as when positive values are obtained. It may be noted that Equation 18 will always give a negative value for CaO when applied to a portland cement composition, and that the same is true when Equation 6 is applied to its oxide composition.

To illustrate the procedure, let us estimate the phase composition of mixture N when at equilibrium at the temperature at which the liquid leaves T_1D to follow the CaO-C_3S surface. To apply Fig. 19, the C_4AF/C_3A ratio of the mixture is required. This is 6.25/13.75 or 0.455. Referring to the figure, it is found that the liquid composition is —11 percent CaO, 25 percent C_3S, 59 percent C_3A, 27 percent C_4AF. The phase composition is expressed by the equations,

$$CaO = -1.6 + 11m$$
$$C_3S = 81.6 - 25m$$
$$C_3A = 13.75 - 59m$$
$$C_4AF = 6.25 - 27m$$

Since C_3A and C_4AF are absent when the liquid is on the CaO-C_3S surface, $m = (13.75 + 6.25)/(59 + 27) = 0.241$. Substituting in the equations it is found that the phase composition of N, at the temperature at which the liquid leaves T_1D to follow the CaO-C_3S surface, is 1.1 percent CaO, 74.8 percent C_3S, 24.1 percent liquid.

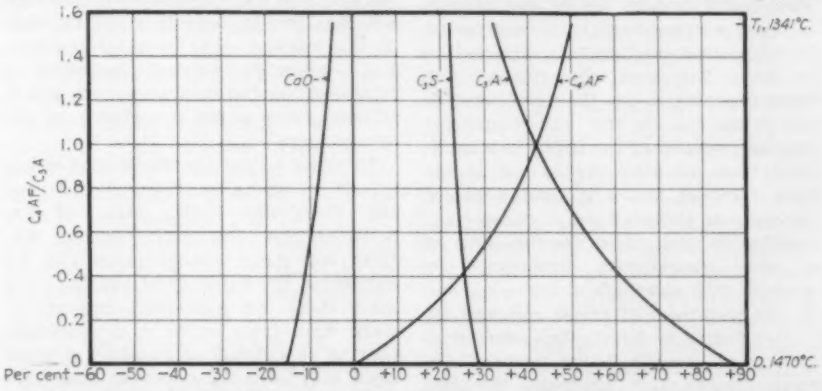


Fig. 19—Diagram for determining composition of liquid in mixtures of types A-2, C-2 and C-4 when leaving quintuple line T_1D to follow CaO-C_3S surface

When Liquid Leaves Quintuple Line T_1X (Types C-1 and C-3)

The range of temperatures on the line T_1X is only 7 deg. C., from 1341 deg. C. at T_1 to 1348 deg. C at X. On that account, estimation of phase composition when the liquid arrives at T_1X has been omitted. The phase composition of any mixture of types C-1 and C-3 when the liquid leaves T_1X may be estimated from Fig. 20, which may be applied in the same manner at Fig. 19. The composition of the mixture must be expressed in terms of CaO, C_3S, C_2S and C_4AF before applying Fig. 20, as in the previous case.

Phase Composition after Liquid Leaves the Quintuple Lines T_1D and T_1X

In portland cement mixtures composed of CaO, Al_2O_3, SiO_2 and Fe_2O_3, of types A-2 and C, the liquid leaves the lines T_1D and T_1X to follow the CaO-C_3S surface. The data for this surface have not been analyzed to an extent sufficient to permit discussion of the estimation of phase composition when the liquid is on the CaO-C_3S surface. It may be observed, however, that solid CaO (free lime) is present when the liquid leaves the lines T_1D and T_1X to follow the CaO-C_3S surface, and continues to increase in quantity as the temperature is raised. The liquid follows a curve of constant C_3A/C_4AF ratio on this surface, since C_3A and C_4AF are the absent phases. If the compositions of mixture and liquids are expressed in terms of CaO, C_3S, C_3A and C_4AF, the change in composition of the liquid on the CaO-C_3S surface may be described briefly as follows:

As the liquid follows a curve in which the relative proportions of C_3A and C_4AF are the same as in the mixture, the potential percentage of C_3S in the liquid is changing in such a direction

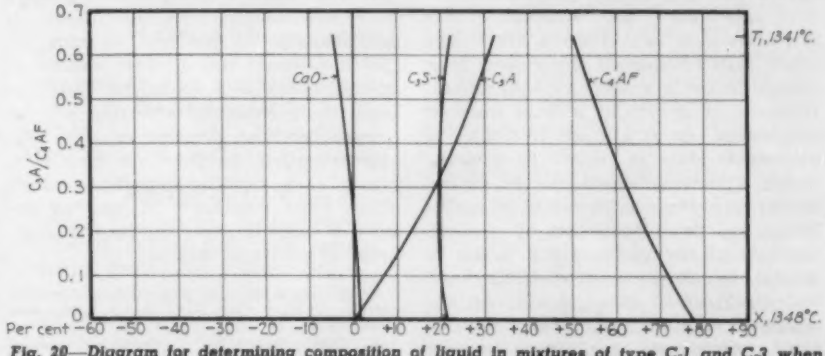


Fig. 20—Diagram for determining composition of liquid in mixtures of type C-1 and C-3 when leaving quintuple line T_1X to follow CaO-C_3S surface

that the relative proportion of the three compounds, C_3S, C_3A and C_4AF, finally become the same as in the mixture. When this point is reached, the mixture consists of solid CaO and liquid. The liquid then leaves the CaO-C_3S surface and follows a straight line in the CaO primary volume, directly toward the point representing the composition of the mixture. The quantity of solid CaO decreases as the liquid moves toward this point. When the point is reached, the last portion of solid CaO disappears, and the mixture is then completely fused.

Delayed or Arrested Crystallization

In the process of fusion which has been discussed, the proportion of liquid increases as the temperature is raised, with a corresponding decrease in the portion consisting of crystalline phases. As the temperature is lowered, this process is reversed. The total amount of crystalline phases increases, and the process is consequently termed crystallization.

When there are no delays in the appearance and formation of crystalline phases the process of crystallization is exactly the same as that of fusion, but in reverse order. Starting with any state of equilibrium attained in the process of fusion, the liquid follows the same path during crystallization as was followed during fusion, but in the opposite direction. Crystalline phases appear and disappear in an order which is exactly the reverse of their appearance and disappearance during fusion. Under these conditions the process may be referred to as normal crystallization. This is the type of crystallization commonly described in reports on investigations of phase equilibria.

The process of crystallization differs from the process of fusion in another respect, that it involves the orientation of atoms into definite structural relationships. It is frequently subject to delays which do not occur during the process of fusion. A particular crystalline phase may form readily when one or more crystals are present as nuclei, but may be slow in making its first appearance, and sometimes may not appear at all. When a crystalline phase fails to appear, the system may appear to be in a state of equilibrium. However, it is not in a true state of equilibrium. Such a state is termed a metastable state. A system in a metastable state may sometimes be caused to change toward a true state of equilibrium by the introduction of a small quantity of the phase which failed to appear, by vibration or other mechanical shock, or by other means. An instance of this kind, with which all cement chemists are familiar, is the stirring of solutions to induce crystallization, as in the determination of magnesia.

Delays in the process of crystallization occur more readily in some systems than in others, and more readily in some parts of a particular system than in others. In the system CaO-Al_2O_3-SiO_2, for example, crystallization occurs so slowly in high silica compositions that it introduced difficulties in the investigation of that system by Rankin and Wright[4]. An example of the opposite type is the system CaO-C_2S-CF investigated by Hansen and Bogue[6]. In this system, crystallization occurs so rapidly that charges quenched by dropping in mercury covered with water were usually completely crystallized.

When crystallization does not occur too rapidly, sudden cooling, or "quenching," may arrest the process of crystallization completely, or practically so. The liquid present before the quench is then hardened without undergoing crystallization, and is then referred to as glass. The crystalline phases and their proportions are then the same as before the quench, the only change being the presence of the liquid in a hardened form, or glass, instead of in the fluid form in which it existed before the quench. Calculations of phase composition in such cases are the same as at the temperature preceding the quench, with glass substituted for liquid in the statement of phase composition.

The degree to which the commercial process of manufacturing portland cement clinker may approach complete arresting of crystallization at a particular temperature is not known. Calculations based on the assumption that crystallization is completely arrested at some point, represent phase composition under an extreme condition which is of interest in seeking further knowledge of the constitution of the commercial product. If crystallization is slow, but not completely arrested at one point in the process, the phase composition of the cooled product can be estimated only after experimental investigations have established the nature and rates of delay in the process of crystallization. This information is not available at the present time. In the meantime, the normal course of crystallization to a particular temperature, then complete arresting of the process, may be assumed as a possible approximation to the true condition, purely as a working hypothesis which offers some possibility of yielding results of value in investigating the properties of portland cement.

[6] Hansen, W. C. and Bogue, R. H. Studies on the System CaO-Fe_2O_3-SiO_2. Jour. Am. Chem. Soc., 48, 1261 (1926); Le Ciment, 13, 398 (1926). Paper No. 1, Portland Cement Association Fellowship, U. S. Bureau of Standards.

West Coast Activities

(Continued from page 58)

Here one can see what, so far as the operators and the editor know, are the only Hercules mills being operated wet as preliminary grinders on slurry. To feed them, holes were cut through the sides, the regular spider feeders were removed, and troughs inserted in the side holes. Water is added at this trough. The ring wear is more rapid than when operating dry; otherwise they seem quite satisfactory for the purpose.

The Diamond plant of Superior, on the waterfront of Seattle is still a "show" plant. It has one of the best equipped laboratories in the industry, one of the prettiest Cottrell electrical dust-precipitator installations, and just completed, a modern well equipped wash and locker house. At this plant, also, the Dyckerhoff spray system for feeding slurry to the kiln has been tried out, but was not in operation at the time of the writer's visit. Some of the special equipment needed, including a Hum-mer 39 heavy duty screen and a Wilfley slurry pump are shown in the illustrations.

In order to see the Dyckerhoff spray system in operation the writer visited the Victorville, Calif., plant of the Southwestern Portland Cement Co. Here the spray system saves fuel by increasing the capacity of the kiln, but loses about an equivalent amount of stack dust, from which it is concluded that to be entirely satisfactory a plant must also have an electrical dust precipitator installation.

All cement plant operators are much concerned at present with methods of saving fuel. At the Redwood City, Calif., plant of the Pacific Portland Cement Co. the second kiln has been equipped with a Lang slurry dryer, designed by A. G. Lang, superintendent, and made by the Traylor Engineering & Manufacturing Co. The original installation was described in ROCK PRODUCTS, January, 1936.

BENTONITE may be used much more extensively if a new material created by the Massachusetts Institute of Technology finds a wide market. The material looks like paper, but it is practically fire-proof, and acid-proof, and is good for writing, printing, wrapping or can be made as transparent as glass. It is a specially prepared thin film of bentonite. Immense deposits of bentonite are found in Wyoming, and five plants are now operating in that state.

GRINDERS OF FINE MICA in the Spruce Pine, N. C., district are expecting a large volume of business from the wall paper mills, and are stepping up their production schedules.

NATIONAL ASSOCIATION ACTIVITIES

Annual Conventions—Sand and Gravel Ready-Mixed Concrete

PLANS ARE MATURING for the joint conventions of the National Sand and Gravel Association and the National Ready Mixed Concrete Association at Cincinnati, Ohio, January 24, 25, 26 and 27. On Tuesday, January 24, there will be boards of directors' meetings; on Wednesday, a joint session featuring "Construction Outlook and Opportunities" by Thomas S. Holden, vice-president, F. W. Dodge Corp., New York City, and "The Highway Program of the Future," by Chester H. Gray, director, National Highway Users Conference, Washington, D. C.

Wednesday afternoon the ready-mixed concrete group will hold an informal round-table discussion on problems pertaining to the industry, while the sand and gravel group inspects the machinery exhibit, which will be officially opened Wednesday evening with a buffet supper and entertainment.

Thursday morning the sand and gravel group will hold a round-table session, which will include one or two leading papers, including "Sand and Gravel Output and Outlets," by Herbert Hughes, U. S. Bureau of Mines, and one by Stanton Walker on sand and gravel research. The ready-mixed concrete group will be free to inspect the exhibit.

On the afternoon of Thursday, January 26, the two industries will meet in joint session. The first speaker will be Col. Willard T. Chevalier, vice-president, McGraw-Hill Publishing Co., on "A Businessman Looks at Modern Conditions." He will be followed by Edwin B. George. economist, Dun & Bradstreet, Inc., New York City, whose subject will be the investigations now being conducted by the Temporary National Economic Committee. Secretary V. P. Ahearn will close the session with a discussion of the Federal Wage and Hour Law, the Walsh-Healey Act, and the National Labor Relations Act.

On the evening of Thursday, January 26, the two associations will hold their annual dinner. There will be no speeches and the evening will be devoted to entertainment.

On Friday morning, the two associations will meet separately and concurrently. Sand and gravel will have round-tables on the following subjects: use of sand, and gravel in bituminous mixtures; use of sand and gravel in stabilized mixtures, special problems in the production of sand and gravel. There will also be the annual election of officers, the report of the Board of Directors, and the presentation of safety trophies.

The separate ready mixed concrete session will be devoted to the very important subject of merchandising methods—of such paramount importance at the present time that the whole session will be devoted to this problem. There will also be the annual election of officers and the report of the Board of Directors.

On the afternoon of Friday, January 27, the two associations will meet jointly in an executive session on the status of employer-employe relations in the sand and gravel and ready mixed concrete industries.

1939 Conventions

Concrete Industries Convention and Exposition, at the Sherman Hotel, Chicago, Ill., February 7, 8, and 9.

National Crushed Stone Association, annual convention and equipment exhibit, at the Netherland Plaza Hotel, Cincinnati, Ohio, January 30, 31, and February 1.

National Sand and Gravel Association, annual convention and machinery exhibit, at the Netherland Plaza Hotel, Cincinnati, Ohio, January 25, 26, and 27.

National Ready Mixed Concrete Association, annual convention and exposition, Netherland Plaza Hotel, Cincinnati, Ohio, January 25, 26, and 27.

Crushed Stone

J. R. BOYD, administrative director, National Crushed Stone Association, announces that up to December 15 there had been 53 booth spaces sold for the January 30, 31 and Feb. 1 exhibit in connection with the association's annual convention. This assures a show equal to last year's, which was among the best.

The program, as thus far announced, includes the following:

BUSINESS PROSPECTS FOR 1939—Gordon Hayes, Professor of Economics, Ohio State University.

STREAMLINING OUR HIGHWAYS—Charles M. Upham, Engineer-Director, American Road Builders' Association.

THE TRANSPORTATION QUESTION IN ITS BROADER ASPECTS—J. B. Hill, President, Louisville and Nashville Railroad Co.

THE HARRISBURG-PITTSBURGH SUPER-HIGHWAY—S. W. Marshall, Chief Engineer, Pennsylvania Turnpike Commission.

ANTI-SKID PROPERTIES OF ROAD SURFACES—Speaker to be announced.

GIVE US THIS DAY OUR DAILY JOB—Whiting Williams.

LIMESTONE SCREENINGS AND STABILIZED EMULSION AS USED IN THE DEVELOPMENT OF THE PARK SYSTEM IN NEW YORK CITY—Frederick H. Gross, Assistant Engr., Department of Parks, City of New York.

HIGHLIGHTS IN THE FIELD OF FEDERAL LEGISLATION—John C. Gall, General Counsel, National Association of Manufacturers.

HOW TO INCREASE THE USE OF AGRICULTURAL LIMESTONE—Speaker to be announced.

Concrete Institute Meeting Dates Advanced

AMERICAN CONCRETE INSTITUTE, Detroit, Mich., has announced through Harvey Whipple, secretary-treasurer, that the convention dates have been changed. The annual convention will be held at the Roosevelt Hotel, New York, Wednesday, Thursday and Friday, March 1 to 3, 1939, and not as originally scheduled on February 21 to 23. This change was made to eliminate a legal holiday from the proposed period.

Ready-Mixed Concrete

NATIONAL READY MIXED CONCRETE ASSOCIATION, Washington, D. C., attempted to get a definition of "perishables" as used in the text of the Walsh-Healey public contracts act, because perishables are not covered by the act. Ready mixed concrete, being almost wholly a

local product, locally distributed, does not come under the federal wage and hour act except in very few instances, but if the material is furnished for jobs on which federal funds are being spent, in amounts in excess of $10,000 worth, it does come under Walsh-Healey act, which limits working hours to 8 hours a day and 40 hours a week, unless time-and-a-half is paid for overtime, union contracts or no contracts.

Prize Definition

The administration has given a definition of when a perishable is not a perishable, which deserves the first prize wooden medal of the International Institute of Word Twisters: Said he: "I am unable to find any basis for approving this product as a 'perishable' within the terms of the Act, for the reason that the quality of perishableness is not inherent in any of its components or in itself, but is merely a condition superinduced for a short time during a certain period of processing."

Sand and Gravel

V. P. AHEARN, executive secretary, National Sand and Gravel Association, in a letter to members transmitting Interpretive Bulletins Nos. 5 and 6 of the administrator of the federal wage and hour law, calls particular attention to a release on office time records, which is merely the administrator's opinion and may or may not be upheld by the courts. The release follows in full:

Business Office Time Records

There has been widely circulated as having the unofficial approval of the Wage and Hour Division the following statement as to the method of keeping records of office employees working on a fixed office hour schedule:

"All over the country business organizations engaged in interstate commerce and therefore subject to the Wage and Hour Law have office forces which operate under a fixed office hour schedule, for instance, from nine to five o'clock with an hour off for lunch. Overtime work in such offices is unusual. Many of such organizations are planning to comply with the regulations requiring records of daily and weekly hours worked by officially announcing to the employees the fixed office hours, with lunch hour off, and directing that no overtime work be done without express official authority in each instance. By this plan, actual records would be kept only as to the hours of overtime worked. This would eliminate the keeping of the regular hours per day where such a fixed schedule is in operation."

In response to various requests to comment upon the foregoing, the Deputy Administrator, Paul Sifton, today issued the following statement:

"Our Regulation Section 516.1 (d) requires records to be kept, with respect to each employe subject to the Fair Labor Standards Act, of 'hours worked each workday and each workweek'. Section 516.2 of our regulations provides that the required records need not be kept in any particular form, 'provided that the information required in Section 516.1 is easily obtainable for inspection purposes'.

"These regulations would seem to require more than a mere 'official announcement' to office employees that their hours per day or per week are as announced. If, in fact, a record is kept with respect to each employee employed on a weekly or monthly basis in an establishment or department thereof operating on a fixed office hour schedule indicating the exact schedule of hours per day and hours per week which that employee is normally expected to work and if, in fact, the pay-roll records maintained by the employer indicate for each worker or for each group of workers that such scheduled hours were, in fact, adhered to, this would be in compliance with our Regulations. When hours in excess of those fixed by the schedule are worked, an employer must supplement this record by showing the exact number of hours worked each day and each week in which they are in excess of the fixed schedule.

"No provision of the Act or of our Regulations prohibits an employer from 'directing that no overtime work be done without express official authority in each instance.' Attention is called, however, to the fact that the Act (Section 3 (g)) defines 'employ' to include 'to suffer or permit to work' and that if an employe is in fact allowed to work even though 'without express official authority', the hours so spent are properly 'hours worked' and must be taken into account in any determination of the question whether the minimum wage or overtime compensation requirements of the Act have been met. If no record of such hours is kept on the pretext that no 'express official authority' to work overtime has been given, the employer will be in violation of Section 15(a)(5) of the Act, and any wage paid which does not take into account such unrecorded hours may be in violation of Section 6 or Section 7, or possibly both of those Sections of the Act.

"It is not allowable to an employer or his supervisory representative to forbid overtime work without 'express official authority' on the one hand and wink at actual overtime work on the other."

Surprising Definition Of Intrastate Business

Commenting on Bulletin No. 5, Secretary Ahearn says: "Paragraphs numbered 12 and 13 bring out the surprising information that the Wage and Hour Division is prepared to hold that certain types of builders and contractors are subject to the federal wage and hour law. After holding that the employees of local construction contractors generally are not engaged in interstate commerce, the bulletin states that employees of contractors engaged in maintaining, repairing or reconstructing railroads, ships, highways, bridges, pipe lines, or other essential instrumentalities of interstate or foreign commerce would seem to be engaged in interstate commerce and subject to the Act. The bulletin goes even further by holding that employees of contractors who are employed in repairing or altering buildings used to produce goods for interstate commerce might be held by the courts to be engaged in interstate commerce and therefore under the coverage of the Act.

"It must be admitted that this involves an application of the federal wage and hour law which heretofore had not been anticipated. If one who works on an instrumentality of interstate commerce is subject to the federal wage and hour law, then those who furnish materials for such construction would seem to be subject to the law. This is one of the most important developments under the statute, and we must make further inquiries before we shall be in a position to recommend a definite course of procedure for member companies."

Lime

NATIONAL LIME ASSOCIATION has issued an interesting and helpful bulletin entitled: "Explanatory Notes for Soil Liming Charts," which contains 10 pp. of text and pictures on why, how and how much agricultural lime to use.

National Asphalt Conference Next February

ASPHALT INSTITUTE has announced that the 12th National Asphalt Conference will be held in Los Angeles during the week of February 27, 1939, instead of February 20th as previously reported. The conference will stress the importance of balanced highway programs and special studies will also include soil stabilization.

Testing Building Materials

TWO BULLETINS have been issued by the National Bureau of Standards, Washington, D. C., whose contents are of considerable interest to the rock products industry. These bulletins cover research reports on building materials and structures.

Report BMS2, by Herbert L. Whittemore and Ambrose H. Stang, covers "Methods of Determining the Structural Properties of Low-Cost House Constructions", and report BMS3 pertains to the properties of wall and plaster boards and the suitability of fiber insulating boards as a plaster base. Such properties as density, strength (flexural and tensile), and linear changes accompanying changes in relative humidity and wetting and drying were studied. In addition to gypsum wall boards and lath, studies involved cement-asbestos board, gypsum plaster, calcined gypsum, hydrated lime and sand.

These studies revealed that three-coat plastering is to be preferred to two-coat plastering, especially with slow-setting plaster; that quick-setting plaster is much better than slow-setting plaster; that weak-oversanded plasters were very unsatisfactory even when ⅝-in. thick; and that strong, quick-setting plasters, ⅝-in. thick, were satisfactory, but when the thickness was only ⅜ in., cracks developed in some instances along the horizontal joints of the lath after the panels had dried.

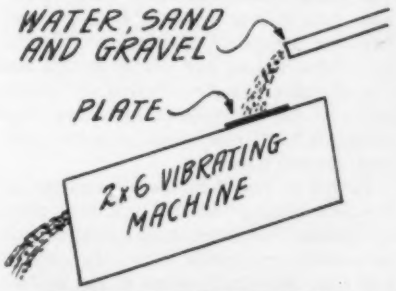
HINTS AND HELPS for Superintendents

Reducing Screen Wear

By S. J. ANDIA

Asst. Supt., Superior Sand & Supply Co.
New Castle, Penn.

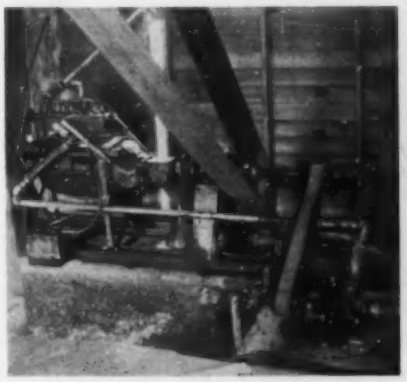
EXCESSIVE WEAR on the first deck screen of a 2- x 6-ft. double-deck screen was largely eliminated by the very simple method shown in the illustration. A section of steel plate, ¼-in. thick, 14 in. long and 20-in. wide, was welded to the screen just where the material and water would drop. The screen now lasts three times longer than it formerly did.



Method of eliminating screen wear

Lowering Power Costs

IN THE SOUTH, where natural gas is available, a manufacturer of concrete products has reduced his power bill to about 30c per day by equipping a Ford Model "A" engine to burn gas as fuel. It was converted by installing a natural gas in place of the gasoline carburetor and by changing the transmission so that the engine operates in "third" speed when the clutch is thrown in.



Equip gasoline engine to use natural gas fuel

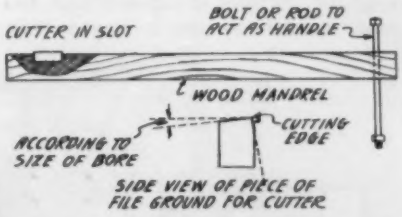
The engine has a battery for starting and a one-shift gear and operates generally at 1050 r.p.m. From the power take-off, the main drive shaft is belt driven, and from it is driven a 14-cu. ft. Stearns mixer and a Multiplex tamper.

In the interest of engine maintenance, a 1¼-in. Fairbanks-Morse centrifugal pump driven by flat belt from the power take-off forces a continuous stream of water through the cooling system—more than is required for most economical operation. The engine has now been in operation over a year without any needed repairs. Cooling water from the engine chamber passes over an improvised cooling tower and recirculates through the pump.

Reaming Out Brass Bushings

By CHARLES LABBE

IN REPAIR WORK it is often necessary to replace brass bushings in the frame or other parts of a machine. Some bushings are held by setscrews, but most are pressed in. Their removal on the job without deforming them can be accomplished by using a strong bolt with a number of large washers and old, large bushings of convenient size. The same bolt and washer arrangement can be used to draw the new bushings into place, thus avoiding the deforming which often results from hammering. This simple device also may be used for taking out bearings of electric motors.


CUTTER IN SLOT
BOLT OR ROD TO ACT AS HANDLE
WOOD MANDREL
CUTTING EDGE
ACCORDING TO SIZE OF BORE
SIDE VIEW OF PIECE OF FILE GROUND FOR CUTTER

Simple device for reaming out bushings

When a bushing is close fitted and after being pressed in place, is somewhat tight, a reamer can be used. In the smaller sizes a hole can be made a little larger by inserting on one side of the reamer a narrow strip of very thin sheet iron (up to .015 in.) but for the large sizes, 2 to 6 in., a wooden reamer made as follows is useful: A piece of wood is turned down to within 1/32 in. of the bore of the bushing. At one end a hole is bored for either a piece of pipe or a long bolt to serve as a handle. A short distance from the other end a slot is made about ⅜ in. wide, 1 in. long and ½ in. deep to accommodate the cutter which is made of a piece of flat file with one edge ground to cutting shape and extending about 1/32 in. above the wood.

After a trial cut, which may do only a little polishing, the cutter is lifted out and a piece of paper is put in the slot to raise the cutter to ream 0.002 in. larger. As many pieces of paper as required can be added to get an exact fit. A few thousandths at a time gives a smooth and easy cut.

Single Reefed Closing Line On Clam Bucket

By ROSS WHEELTON

ONE TYPE OF CLAM BUCKET in use rather widely is noted for its good digging action. One of the reasons for this action is the double sheave blocks with which it is provided. At times, however, when handling somewhat loose materials, such good digging action is not required. In this case the closing and opening time may be considerably reduced by single-reefing the closing cable. As shown in the accompanying illustration, one sheave at the top and one at the bottom is dispensed with. This simple procedure speeds up the "clamming" operation remarkably. When again handling material requiring heavy digging, the cable can be reefed double as before.

Speeding up operation of clam bucket in handling loose materials by single-reefing the closing cable

Another noticeable advantage of the single reef, aside from the increase in speed is the longer cable life due to the smaller number of bends.

Replacing Crushing Surfaces By Welding

By E. H. FLEISCHMAN.*
Keystone Portland Cement Co.,
Bath, Penn.

IN CRUSHING OPERATIONS in the rock products industry, it has been the custom to replace the crushing surfaces with new renewable surfaces, using these parts until they have been worn out. These surfaces are made of hard steel, chilled iron or manganese steel. A large part of the worn out pieces had to be discarded as scrap because they wore out unevenly. Another disadvantage was that as surfaces wore the sizing of the product changed. In operations involving subsequent grinding of the crushed product, like the cement industry, it is very desirable to keep a uniform size of particles in the feed to the grinding mills, as this results in marked economy of grinding media and power.

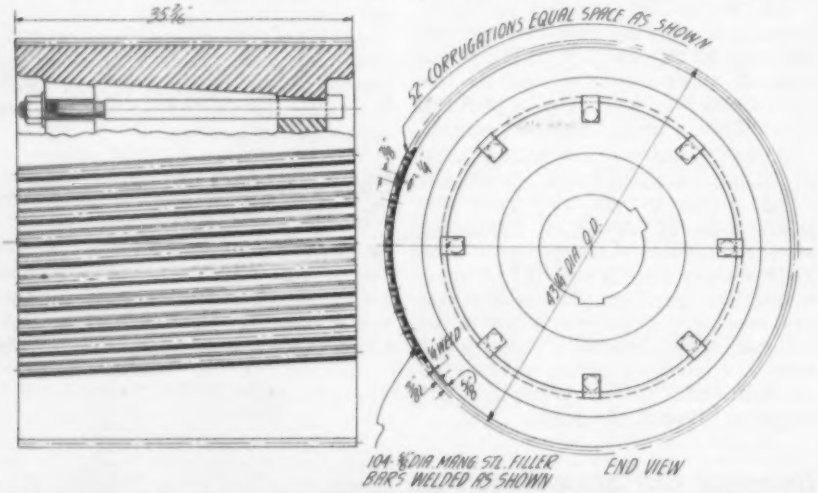


Diagram of crusher roll having corrugated wearing surface, which is built up by electric welding, using nickel-manganese rod

To overcome these defects, a crushing surface was designed which could be built up from time to time by electric welding. The machine for which the new crushing surfaces have been made is of the simple two-roll crusher type, both rolls being turned by suitable gearing, and the material to be crushed is fed between the rolls. One of the rolls is preferably corrugated as this helps to size the material. This method of welding on a wearing surface is not confined to this type of crusher, however, as it can be used equally well on gyratory or jaw crushers.

The method of making the crushing surface is as follows: a steel of suitable characteristics, from 0.20 to 0.40 per-

*As previously mentioned in ROCK PRODUCTS, the author was the recipient of one of the awards sponsored by The James F. Lincoln Arc Welding Foundation for his paper on this subject.

cent carbon, which is tough and firm but not too hard to weld on properly, is formed into the proper shape and machined. The crushing surface is then built up by depositing nickel-manganese welding rod to form the crushing surface, building this up to a thickness sufficient to last the required time before the next building-up. Corrugations can be formed by using manganese filler bars, or by depositing extra beads of weld metal. In some cases it may be preferable to use some other hard-surfacing rod, but nickel-manganese rod is very good for this purpose as it is shock-resistant and does not spall. As the surface is worn down by use it is merely built up again from time to time without removing the part from the machine and in most cases, without interruption to production.

The cost of installing the improved crushing surface is substantially the same or perhaps slightly greater than the old method. The old method used a more expensive material throughout, while the new method uses a cheap material for the base but a more expensive material for the wearing surface. Gross savings to industry obtained by the above methods result from decreased maintenance costs and increased uniformity of product. By actual use, 200 lb. of nickel-manganese rod was used to crush 1,075,000 bbl. of cement clinker, the cost per bbl. amounting to $0.00015.

Quarry Operator Applies Electric Welding

By NELSON SEVERINGHAUS.*
Consolidated Quarries Corp.,
Lithonia, Ga.

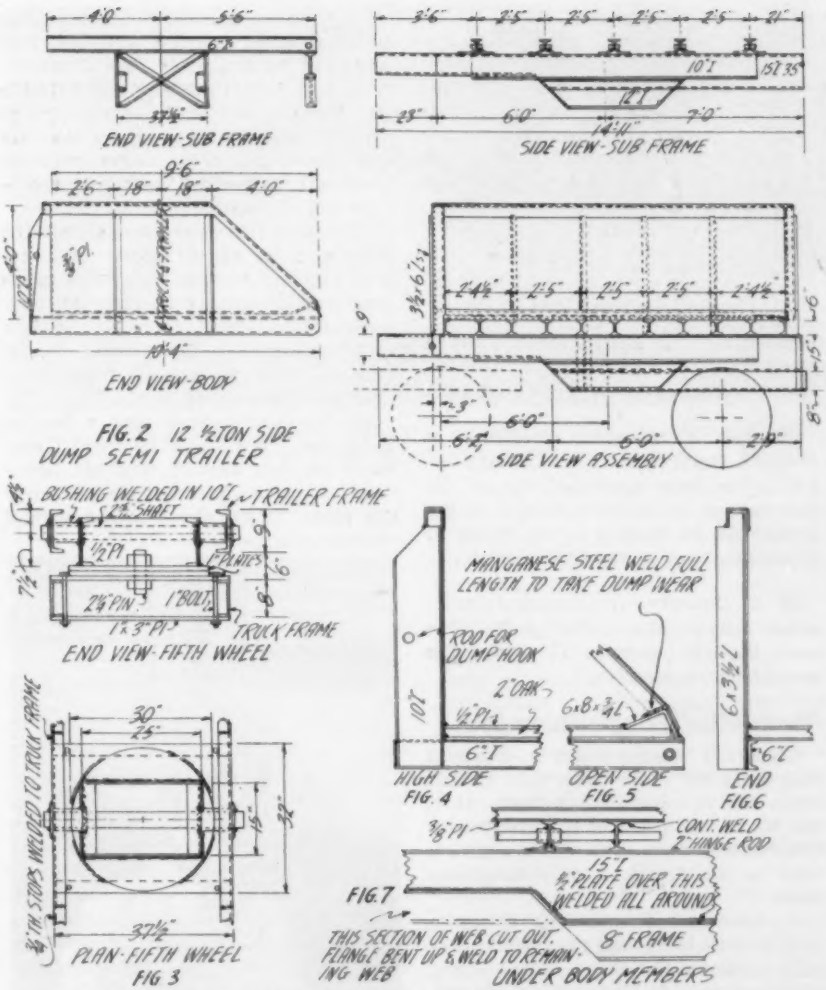
AN IMPROVED TYPE of semi-trailer unit has been designed and is now in use by the Consolidated Quarries Corp., Lithonia, Ga. It was designed for construction by electric welding of standard structural shapes and plates as this was considerably cheaper than other methods and did not require extensive shop equipment. It also gives a more rigid and rugged assembly.

It will be noted in the illustration of the new haulage unit, Fig. 1, that most of the side dumping strain is transferred to a block supported from the ground and that practically none of the shifted weight is transmitted to the truck chassis. The open side, flat bottom construction of the new unit also provides a low center of gravity under load, reducing strains to chassis in traveling over rough roads near quarry shovels.

In the new type body, the high closed side is at right angles to the flat floor, and is welded securely to straight sup-

*As previously mentioned in ROCK PRODUCTS, the author was one of the award winners in the contest for the best papers on welding sponsored by The James F. Lincoln Arc Welding Foundation.

Fig. 1. Semi-trailer body, constructed by welding the assembled parts, dumping load into crusher hopper. Note how side dumping strain is transferred to a block supported from the ground



Assembly and construction details of new type, welded semi-trailer body

porting I-beams resting on the frame and running full width. An I-beam, which takes weight on the near side, during dumping, runs full length and aids in lengthwise rigidity. This box-like section should be considerably harder to bend and is easy to construct.

The new unit is largely welded with only a few rivets used in holes found desirable for bolting members together during assembly by welding. This rigid welded construction should lower repairs on a body subjected to constant shock and vibration.

Assembly and details are shown in Figs. 2 to 7, inclusive. In construction, the four cross I-beams and two cross channels which fasten to and brace the dump part, were first welded down on the ⅜-in. body bottom plate with a continuous weld along both flanges. The sub-frame was then assembled as shown in Figs. 2 and 7, and fastened on to the rear section of an old Mack 5-ton chassis with welded fishplates and braces. It will be noted that only a short section of the old chassis was used at the rear end to give a convenient wheel, axle and spring mounting and that the main frame of the semi-trailer is made by two 15-in. channels which are part of the body sub-frame. To avoid weakening these channels with bolt or rivet holes, the five I-beams fastened to them were secured with bent clips welded on as shown in Fig. 7.

The assembled floor of the dump part was next turned over onto the frame and secured by a 2-in. diameter hinge pin running full length. Hard bushings with provision for lubrication were welded into the fixed beams and the hinge pin welded to the movable beams as shown in Fig. 7.

To secure adequate fastening of the 10-in channel side braces, one side of the top flange of I-beams to which they fasten was removed for 10 in. and the braces welded all around to web and bottom flange.

Side and ends were next attached as shown in Figs. 4 and 6, and the ⅜-in. bottom plate welded to them all around. To take the shock of large rocks, sometimes weighing several tons and dropped for several feet from shovel dippers, a sandwich type floor was used with 2-in. oak boards between a ½-in. top plate and the ⅜-in. bottom plate. The top plate was also welded all around to side and ends as this helps greatly to keep these members from bending outwards.

On the open dump side, a 6- x 8- x ¾-in. angle iron, placed as shown in Fig. 5, forms a slight rise to prevent rocks from rolling out in transit. Owing to the abrasiveness of rock handled, the top edge of this angle was given a welded overlay of manganese steel to take the wear during dumping. This is shown in Fig. 5. Two angles which are welded together and reinforce the top edge of ends and side were cut out on their ends and bent to lap down over this 6- x 8-in. angle and welded to it securely. This helps to brace the ends when they take punishment during loading. The heavy dumping edge angle was also welded to the top floor plate for the full length of the body.

The fifth wheel also was constructed of plates and structural shapes welded together as shown in Fig. 3. It is considerably heavier than the usual fifth wheels but its duty is very severe. The following tabulations show cost and operating comparisons between this semi-trailer unit and a conventional 8-cu. yd. side dump body of riveted construction:

COMPARISON OF FIRST COST

	New Trailer Unit	Old Type Unit
First cost	$1388.28	$1137.79
Av. tons handled per trip	12.5	6.5
Cost per av. ton handled	$111.06	$175.04
Saving per ton of capacity	36.5	

OPERATING COSTS

	New Trailer Unit	Old Type Unit
Tons handled per hr. operation	77	40
Costs per hr. operation:		
Driver	$0.385	$0.385
Gasoline	.382	.347
Lubricating oil	.055	.055
Tires	.272	.245
Repairs	.435	.435
Total Cost per hr.	$1.529	$1.467
Cost per ton handled	1.99c	3.66c
Cost saving per ton handled	1.67c	
Percentage saving in operting cost	45.7%	

WINTER WEATHER and its accompanying ice and snow creates a new market for stone chips, sand and slag fines for use as abrasives in preventing accidents on highways and city streets. Highway departments, city bureaus of streets, and city transportation systems are ordering supplies of aggregates for this purpose and are stockpiling these materials or placing them in bins. Calcium chloride is very often mixed with the abrasives to prevent freezing and also to melt ice and snow when the materials are spread on the ice-covered roads.

NEWS about People

BLAINE S. SMITH, president of the Universal Atlas Cement Co., Chicago and New York, has been appointed a member of the board of directors of the National Association of Manufacturers by its newly elected president, Howard Coonley.

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WHITNEY S. WILSON has been appointed manager of the Olympia, Centralia, and Shelton, Wash., plants of the Concrete Pipe Co., Seattle, Wash., according to an announcement made by President W. F. Paddock. He succeeds the late W. W. Johnstone, who was widely known among public officials, contractors, and material men.

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FRANK P. SPRATLEN, JR., writes us a personal letter in which he mentions incidentally that on December 1, 1938, the official name of the J. W. Brannan Sand and Gravel Co., Denver, Colo., was changed to Spratlen-Brannan, Inc. Although "Bud" Spratlen has been president of the company for several years, his many friends will be happy to see his name in the company's. Bud's letterhead, under the company name, carries the words "Lightning Service." So the candid photo the editor took in his Denver office last September is quite appropriate. After several years of quiet, construction in Denver took quite a spurt in 1938 and Spratlen-Brannan, Inc., being ready for it, had a good year.

Frank P. Spratlen

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WALTER A. SCHMIDT, president of Western Precipitation Co., Los Angeles, Calif., has been appointed one of the members of an advisory council to the Committee on Patents of the House of Representatives of the United States.

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D. S. COLBURN, vice-president, Marquette Cement Manufacturing Co., Chicago, Ill., left December 17 on a cruise around South America.

Victorville's Superintendent

THERE'S A CEMENT PLANT in southern California the editor never fails to visit when the circumstances permit. It is the Victorville plant of the Southwestern Portland Cement Co. It is a garden spot in the desert; a very hospitable oasis.

A recent visit was particularly enjoyable because the young man whose portrait is shown herewith and the editor discussed many things about cement. O. C. Halstead is probably one of the youngest plant superintendents in the industry—at least he looks it, and he is open-minded, as both young and old men can afford to be.

During one lull in the conversation the editor glanced at a bronze bust in the corner of the office, of the late Carl Leonardt, founder and president of the company for many years. Said the editor, "Well do I remember my first meeting with Carl Leonardt. It was 20 or more years ago, as a new and unknown editor of ROCK PRODUCTS I dropped into the company's offices in Los Angeles, and asked to see Mr. Leonardt, little expecting to have that honor for the asking.

"Mr. Leonardt himself came out to the reception room. What did I want to do and see while in Los Angeles? Well, of course, I wanted to see the Victorville plant. That was easy; it was 100 miles away, out on the edge of the Mohave desert, but a club house was there for visitors and I was welcome to go and stay as long as I pleased. What next? Being frank as usual, I said I wanted to visit the Corona Rock Co's plant—a crushed stone operation about 60 miles from Los Angeles, since destroyed by fire. Said Carl Leonardt, 'You wait fifteen minutes and I'll take you there myself.' He called his car and his chauffeur and spent the day with me—a day never to be forgotten because I learned to know and appreciate Carl Leonardt.

"The Victorville plant was always the pride and joy of his heart. He built it of concrete when other cement manufacturers advertised 'concrete for permanence' but built their own plants of something else. He prettied up the grounds; said no cement plant need look the way they all did."

Mr. Halstead listened with a twinkle in his eye. "Nor," said he, "will I ever forget my first meeting with Mr. Leonhardt. I was an assistant electrician at this plant. To get ahead in the world I was doing part of the night shift as caretaker of the power house as well as working in the shop by day. [Young men can't get ahead in the world by these methods any more because their Uncle Sam says it's unlawful!—the editor's interjection.]

O. C. Halstead, superintendent Southwestern Portland Cement Co., Victorville, Calif.

"As an attractive stopping off place on the edge of the desert—there wasn't any Victorville then except the railway station and the plant—the power house had gradually become known to itinerant travelers without visible means of support as a convenient place to spend the night.

"Although they did no particular harm, evidently one day it was decided that they were too great a nuisance, for when I arrived for my power house shift I found several uninvited lodgers as usual; but on the wall was a notice posted by the superintendent to the effect that such guests were no longer to be allowed. So, I awakened them,

Office of the Southwestern Portland Cement Co., at Victorville, Calif., in a setting of lawns and shade trees in desert country

showed them the notice, and ushered them out.

"In the quite early morning another guest appeared, in slouch hat and with the kind of clothes most all of us prefer to wear around a cement plant. I showed him the notice, and insisted on his leaving, notwithstanding his somewhat excitable, but to me rather unintelligible protests. Later in the day, while working at my bench in the shop I spied my acquaintance of the morning coming through with the superintendent and other officials of the company, and although I had never met Carl Leonardt, it began to dawn on me, who the gentleman was that I had ejected from the power house. For, you see, he had a habit of taking an early train and going direct to the plant without ceremony, and that morning he had gone to enjoy the power house of which he was particularly proud.

"To make a long story short, Mr. Leonhardt recognized me, and said after shaking hands: 'Aren't you the young man who put me out of the power house?—That was right my boy, orders is orders."

So the young assistant electrician who put his boss out of his own plant has become the superintendent of the plant.

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MRS. MAE M. ARINGTON has been elected president of the Santa Fe Sand and Gravel Co., Escalon, Calif., which was recently reorganized. Mrs. Arington has been actively in charge of operations at the pits for the past nine months. In addition to sand and gravel, the company also produces ready-mixed concrete. Other officers are: F. J. Marx, vice-president; L. J. Smallpage, secretary; and Miss Ethel Arington, assistant secretary.

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E. LEE HEIDENREICH, JR., formerly general superintendent of the New York Trap Rock Co., with headquarters at Newburgh, N. Y., is now engaged in consulting work. Mr. Heidenreich was connected with the New York Trap Rock Co. for 12 years and prior to that had been with the Burrell Engineering and Construction Co., Chicago.

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W. E. FARRELL, head of Easton Car & Construction Co., Easton, Penn., recently celebrated his 25th anniversary as president of the company. Over the past 25 years since October 13, 1913 when Mr. Farrell took over the management of the old Ernst Weiner Co., and renamed it the Easton Car and Construction Co., the organization has expanded and taken over other business enterprises until today it is one of the leading companies serving the rock products industry. The present company was incorporated February 9, 1914. In August, 1931, it purchased the industrial division of the Lakewood Engineering Co., Cleveland, Ohio, acquiring a line of industrial storage battery trucks. In addition to its material handling equipment, the company also manufactures the Clarmac system for the electric heating of bitumen. The main office is in Easton with branch offices in New York, Philadelphia, and Pittsburgh. In additon to Mr. W. E. Farrell, other officers are: J. C. Farrell, vice-president; and R. C. Haggerty, secretary-treasurer.

W. E. Farrell

Obituaries

HARVEY A. TUTEWILER, president of the Ready Mixed Concrete Corp., Indianapolis, Ind., was killed on December 8 in an automobile accident. Mr. Tutewiler organized the company seven years ago, after having been associated with the Standard Paving Co. for 25 years.

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WILLIAM J. CHALMERS, retired chairman of the Allis-Chalmers Co., Milwaukee, Wis., died recently at the age of 86. From boyhood to his retirement, Mr. Chalmers was engaged in the manufacture of mining machinery. He was born in Chicago, the son of a Scotch immigrant, who was superintendent of a machinery company. In 1872 he helped to form the original copartnership of Fraser, Chalmers & Co., which was consolidated in 1891 with the E. P. Allis Company to form the Allis-Chalmers Co. Mr. Chalmers headed the company for many years, retiring in 1906. He was noted for his philanthropies and activities in civic enterprises.

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EDWARD P. ALKER, prominent banker and former vice-president and treasurer of the Pennsylvania-Dixie Cement Corp., died November 18.

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E. B. WATSON, SR., head of the Watson Sand and Gravel Co., Fluker, La., was killed December 10 when his automobile was struck by a passenger train. He was a former Louisiana State Senator. His son, E. B. Watson, Jr., is general manager of the company.

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DONALD K. BRYMER, for more than 17 years connected with Graham Bros., Inc., Los Angeles, Calif., died recently. He began his career with the company at their Santa Catalina Island quarry, and was later transferred to the position of plant superintendent of the unloading distributing plant at Long Beach, Calif. When operations at Catalina island were discontinued, he was placed in charge of ready-mixed concrete activities in the harbor area.

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PERCY C. DAY, vice-president and chief engineer of the Falk Corp., Milwaukee, Wis., died December 7. Mr. Day came to the United States in 1910 from England, where he had been a power plant engineer, and became associated with the Falk company. He was named vice-president in 1937.

NEW MACHINERY AND EQUIPMENT

Mechanical Separator

WILLIAMS PATENT CRUSHER & PULVERIZER Co., St. Louis, Mo., has brought out during the past year a mechanical separator which is said to embody features in its design which result in a

An 18-ft. diameter mechanical separator assembled, ready for shipment

small percentage of fines in the tailings while at the same time having a high rate of production. Construction is sufficiently heavy for dependable operation. The separators range in size from 2½ to 18-ft. diameter.

Load-Forward Truck Hauling Equipment

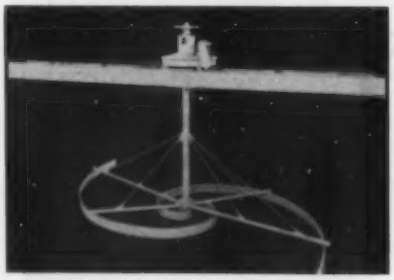
DEMPSTER BROS., INC., Knoxville, Tenn., is now in production of what is known as the Load-Forward Dempster-Dumpster. By a simple mechanism, the entire detachable container is carried forward on the truck chassis, an arrangement which is said to allow larger capacities on smaller trucks. A patented dumping mechanism permits the truck driver to discharge the contents quickly by means of levers operated from the cab. The entire load may be discharged at once or gradually, as desired. This model is furnished in sizes ranging from 1 to 6 cu. yd.

Hauling equipment has mechanism permitting the entire detachable container to be carried forward on the truck chassis

Improved Thickener Mechanism Prevents Breakage

HARDINGE CO., INC., York, Penn., has developed a new thickener mechanism known as the "Auto-Raise." With the new mechanism, it is asserted that damage or breakage to thickener parts in the case of an overload in the thickener tank, is prevented.

Thickeners, quite generally, operate for long periods without difficulty. Suddenly they become overloaded due to some obstruction dropping into the tank, or solids, building up on the scraping



Spiral thickener with lifting mechanism to prevent breakage

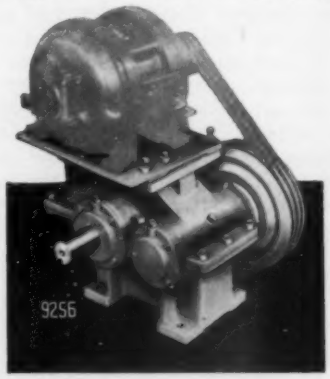
mechanism, or on the inside of the tank, become loose and drop to the bottom in a heavy mass. This takes place so quickly that even overload alarms and stopping devices on the thickener fail in preventing breakage because the mechanism cannot stop rapidly enough.

It is said that breakage of this kind cannot occur when the "Auto-Raise" thickener mechanism is used, because the moment the scraper encounters such an obstruction, the resistance is transmitted to the driving mechanism where a separate sleeve, with slots set at an angle, is located and which drives a yoke attached to the scraper shaft or torque tube. The instant the resistance against the torque tube increases above a predetermined degree, this yoke "walks up a hill" until the resistance is relieved. There it stays until the resistance is removed, and then it backs down to its proper position.

Constant Speed Reducer

STEPHENS-ADAMSON MFG. CO., Aurora, Ill., has added a line of constant speed reducers which will be known under the trade name of Saco. This is an addition to their present line of J.F.S. variable speed reducers.

These new constant speed reducers, it is claimed, can be used with any standard, full speed motor to give the required output speed. The motor support is adjustable for V-belt drive, permitting sheaves to be replaced to suit changes in required output speed. Output speed has a wide range, varying



Speed reducer used in many conveying applications

from 13.2 r.p.m. to 172 r.p.m. There are many applications for this speed reducer, and they are now being used in the operation of Redler conveyor-elevators, belt conveyors, feeders, elevators and screw conveyors.

Excavator Equipped with Vacuum Control

THE MARION STEAM SHOVEL CO., Marion, Ohio has incorporated in the Type 352 excavator, recently developed, several features of interest, including a velvo-grip hoist and crowd clutches, vacuum controlled dipper trip, and vacuum controlled rotating clutches. As a shovel, the Type 352 is equipped with a 1¼-cu. yd. dipper.

The velvo-grip hoist and crowd clutches are said to enable the operator to have the "feel of clutch" at all times, assuring smooth handling and accurate spotting of loads. With the vacuum controlled dipper trip the shovel operator can trip the dipper without removing his hand from the main lever, for the control valve is mounted on the main lever. A single lever at the operator's station opens and closes vacuum

Excavator has vacuum-controlled rotating clutches and dipper trip

valves controlling the rotating clutches, which are of the cone type.

Convertible into a crane, clamshell or pull shovel, the Type 352 is powered by gas, Diesel or electric motors. For the gas and Diesel-powered shovels, a 100-gal. capacity fuel tank is provided.

Compeb Mills Dry and Grind Raw Materials In One Unit

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis., has brought out a Compeb mill designed to dry and grind cement raw materials within one unit. This mill, in effect, resembles closely their standard No. 8726 dry grinding Compeb mill, but it receives preheated air from an oil-fired air heating furnace, the heated air from which is drawn through the first compartment of the mill. From this compartment it passes out of the mill shell, after absorbing a large amount of moisture, through the peripheral screen surrounding it at the junction of the primary and secondary grinding compartments.

This mill is designed to operate with raw materials containing not over 3½ percent moisture, and the capacity is rated on that basis at 20 tons per hour with 1⅛-in. ring size feed, the material to be ground to 91 percent minus 200 mesh.

The mill is loaded with 30,000 lb. of assorted balls, and 58,000 lbs. of 1¼-in. concavex. The oil fired air heating equipment, manufactured by the Continental Industrial Engineers, Inc., Chicago, Ill., heats 250 lb. of air per minute to approximately 600 deg. F. This air, in passing through the primary mill compartment, carries out a large part of the moisture contained in the raw materials. The dried and partly ground raw materials which pass through the peripheral screen of the mill are fed to the second mill compartment through a scoop feeder. In order to insure complete drying so that the secondary grinding operation is not impaired, ambient air is drawn through the second compartment of the mill which is heated by the action of the grinding charge within the compartment, and if any moisture remains in the material, it is carried out by this second stream of air which unites with the moisture ladened air from the first compartment. The two air streams in this mill are approximately of the same weight. The calculations were made to determine the quantity of air in the two compartments so that the moisture ladened air from the first compartment, which is heated to approximately 600 deg. F. before it enters the mill, in uniting with the secondary compartment exit air, preheated by the heat generated in grinding, comprise a mixture which is heated to approximately 160 deg. F., which is higher than the dew point of the moisture ladened mixture of the two air streams.

It is necessary that the air temperature be kept above the dew point because the air contains a considerable amount of dust which must be eliminated from the air stream by means of a dust collector so that the air may be rendered comparatively dustless in passing from the unit.

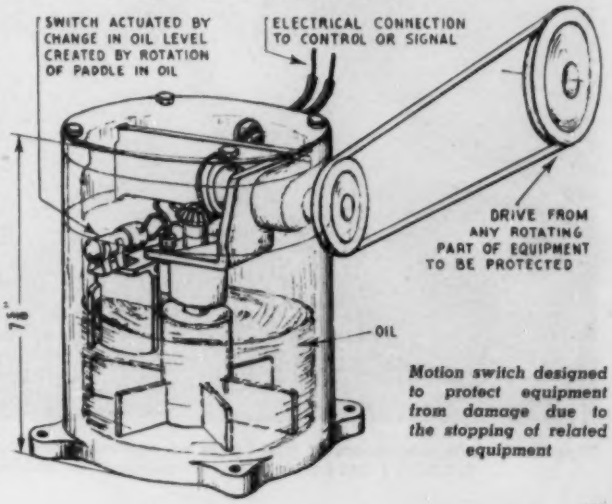
In conjunction with this mill installation a No. 22-7-½ "D" Sirocco dust collector is used. This collector is of the centrifugal type, and removes a large percentage of dust from the air stream which come from the mill. The air streams from both compartments are induced through the mill by a No. 45 type "E" ABC exhauster. The mill is equipped with a 500 hp. synchronous motor.

Larger Capacity Mill

To conform with the requirements of other cement manufacturers, in which an even greater tonnage is required, the Allis-Chalmers Manufacturing Co. has developed a mill 10½ ft. inside diameter, and of a length 16 ft. or longer, depending upon the grinding requirements. One of the 10½-ft. diameter mills which has been designed will require approximately 1000 lb. of air per minute heated to 600 deg. F., the general design of which conforms to the No. 8726 Compeb mill. In making possible the effective heat transference from the heated air to the material at such a large tonnage, the first compartment of the mill is equipped with lifters to permit the material to be showered through the air stream. It may be noted that in this larger mill means are not provided to draw ambient air into the third, or fine grinding compartment. This mill, in which the drying is performed largely in the first chamber, equipped with lifters, and to a lesser degree in the second chamber, which is the primary grinding chamber, the moisture ladened air passes directly to the dust collector, and no attempt is made to dry in the fine grinding chamber of the mill.

Protective Switch

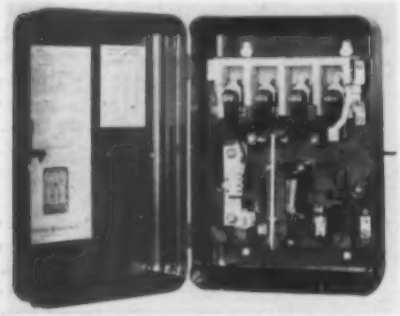
FULLER CO., Catasauqua, Penn., has developed a "motion switch" which is a device used to automatically protect equipment against damage due to unforeseen stoppage of related equipment. For example, the switch, when driven by the motion of a screw conveyor tied in electrically to the elevator that feeds the screw conveyor, will automatically stop the elevator if the screw conveyor should stop for any reason.


SWITCH ACTUATED BY CHANGE IN OIL LEVEL CREATED BY ROTATION OF PADDLE IN OIL
ELECTRICAL CONNECTION TO CONTROL OR SIGNAL
DRIVE FROM ANY ROTATING PART OF EQUIPMENT TO BE PROTECTED
OIL

Motion switch designed to protect equipment from damage due to the stopping of related equipment

Starter for Single-Phase Motors

GENERAL ELECTRIC Co., Schenectady, N. Y., has announced the development of a magnetic switch for use with single-phase motors. The new device, which is



Single-phase magnetic switch with molybdenum contacts, overload and undervoltage protection

available in ratings of 3 hp. at 110 volts, 5 hp. at 220 volts, and 7½ hp. at 440 volts, consists of a standard general-purpose, 4-pole magnetic switch with two poles connected in parallel. This arrangement makes the device equivalent to a 2-pole switch with one overload relay. Its application is limited to use with single-phase motors whose normal full-load current does not exceed 30 amperes.

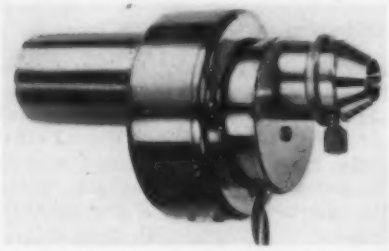
Cab-Over-Engine Dump Truck

FORD MOTOR Co., Detroit, Mich., has announced the 1939 line of trucks which are equipped with hydraulic brakes and have a wide selection of capacities, gear reduction ratios and power. There are 42 body and chassis types, two clutches, five transmissions and eight rear axle ratios, in addition to various wheel and tire sizes. Operators may obtain V-8 trucks which are virtually custom-built for their own particular transportation problems.

Three V-8 engines are available for 1939. The new 95-hp. engine with a piston displacement of 239 cu. in., a bore of 3.185 in. and stroke 3.75 in., develops a torque of 170 lb.-ft. at 2100 r.p.m. Main bearings, 2.5 in. in diameter, have a total bearing surface of 36.81 sq. in. The improved 85 and 60 hp. engines complete the line.

Radiation Pyrometer

THE BRISTOL Co., Waterbury, Conn., is offering a radiation pyrometer which uses as a temperature-sensitive unit,



Radiation pyrometer which measures temperatures instantly by sighting object

the Ardometer, shown in the illustration.

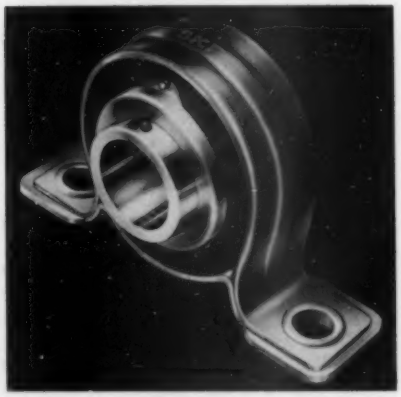
This instrument measures the surface temperature of hot objects or masses above 1000 deg. F., when the Ardometer unit is sighted so that it picks up the heat rays emitted. The temperature is recorded on a potentiometer—on a round- or strip-chart recorder—or is indicated on a millivoltmeter pyrometer.

The Ardometer has this important feature: it can be sighted directly on the object in the furnace and in this position it measures instantly the temperature of the object itself. It is claimed that it follows with fidelity the temperature changes in the material on which it is sighted.

Vibration-Proof Pillow Block

SKF INDUSTRIES, INC., Front St. and Erie Ave., Philadelphia, Penn., has placed on the market a pillow block, known as "Rubber-Flex". This unit comprises a self-locking bearing of the "grip-lock" type. The bearing is said to be inherently aligning, thus compensating for inaccuracies of set-up and conditions of shaft misalignment without binding or in any way impairing the load-carrying capacity of the bearing.

Encased in a pressed steel housing, the bearing is equipped with felt seals to exclude dirt. The housing is provided with means for lubricating the bearing. Bearing and housing are surrounded



Pillow block which is inherently aligning and has a self-locking bearing

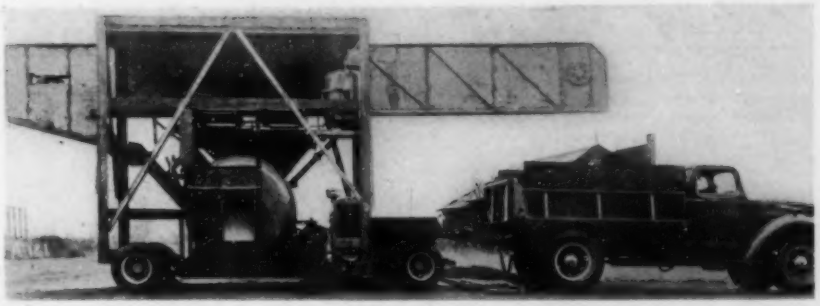
with an elastic material having special sound-absorbing characteristics, and the material has been specially treated to make it impervious to oil and grease.

Portable Concrete Plant

ERIE STEEL CONSTRUCTION Co., Erie, Penn., has developed the Strayer portable concrete mixing plant, shown in the illustration. This unit appears to offer possibilities to ready-mixed concrete operators who desire to service jobs at locations which are not readily accessible to a permanent plant.

Exclusive of cement handling, the plant is operated by one man. All controls except those for engine, elevator drive, and hoist are located on the operator's platform. The plant is loaded by means of a vertical elevator equipped with a large truck hopper, the elevator being driven by the same power unit which drives the mixer. It is said to conform to highway clearances, and yet has a mixer, bin and loading capacity

Dump truck of the cab-over-engine type has 95 hp. engine; choice of rear-axle ratios of 5.14 to 1, 5.83 to 1 and 6.67 to 1; and is equipped with hydraulic brakes



Portable concrete mixing plant operated by one man has a capacity of 32 cu. yd. of concrete per hour

for producing nearly 32 cu. yd. of concrete per hr. The complete plant, including bin, weighing AggreMeter, bag cement hopper, mixer, power unit, and material elevator with truck hopper is mounted on a steel truck frame having dual pneumatic tires.

Excavator Features High Speed and Mobility

THE GENERAL EXCAVATOR CO., Marion, Ohio, has announced the General 41, of ¾ cu. yd. capacity.

High speed and mobility are the two outstanding characteristics claimed for this model. Two travel speeds are obtained through speed change gears and in addition, the gasoline motor may be quickly accelerated at the will of the operator. Another feature is its chain crowd. A split sprocket is bolted to the right hand drum shaft, and serves as a crowding unit. No special crowd unit need be placed on the machine. Boom is adjustable to all angles without affecting crowd chain tension.

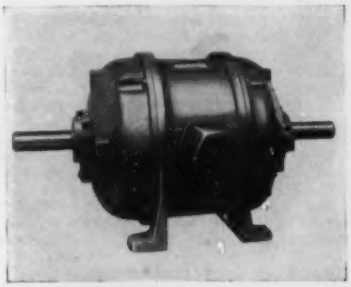
Retract motion, twice the speed of crowding motion, is obtained from a horizontal intermediate shaft which carries a friction clutch on one end, and sliding gears with selective jaw clutch. This same intermediate shaft also motivates the power boom hoist which is independent of hoist, swing and travel motion and is of the worm and worm gear type, oil bath lubricated. An automatic band brake on the worm shaft is an added safety feature of the excavator.

Excavator has a split sprocket bolted to drum shaft, serving as a crowding unit

Hoist drum clutches and brakes are of the outside contracting band type with wide faces and large diameters for easy and efficient operation. Clutches are set by the "easy touch" booster mechanism. Swing and travel motions are controlled by two friction reversing clutches of disc type. Selective jaw clutches are used to engage either the swing motion or travel motion.

Hoist Motors

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Penn., has announced the Type CS hoist motor, said to be particularly applicable for



Motor adaptable to hoist or car spotter applications

hoist service, car spotters, etc. It is claimed that the high resistance rotor provides the highest ratio of starting torque to a starting current obtainable with a squirrel-cage motor. Light loads are handled quickly while heavier loads cause the speed to decrease with a corresponding increase in torque.

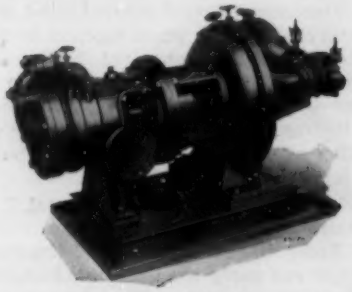
Correction

ON PAGE 57 of the December, 1938, issue of ROCK PRODUCTS, under the title, Truck Mounted Shovel, the weight of the new truck shovel made by The Hanson Clutch and Machinery Co., Tiffin, Ohio, was given as 12,000 lb. This should have been given as 20,000 lb. The mounting alone weighs 12,500 lb.

RICKETSON MINERAL COLOR WORKS, Milwaukee, Wis., announces that some special colors have been developed for the concrete brick manufacturers. This company also manufactures cement colors in 16 standard shades used for coloring all types of concrete products. It also makes mortar colors and plaster colors.

Turbine-Driven Pump

INGERSOLL-RAND CO., Phillipsburg, N. J., has announced a turbine-driven pump which features a compact construction, combining both turbine and pump as one unit on a common shaft. This pump, known as the "class TRV," is built in



Pump which combines both turbine and pump as one unit on common shaft

single-stage sizes for capacities from 5 to 1000 g.p.m. against heads as high as 220 ft., and in two-stage sizes for capacities to 275 g.p.m. and heads up to 550 ft.

Feed Roll For Feeding Hydrated Lime

ARNOLD & WEIGEL, INC., Woodville, Ohio, has brought out a small feeding mechanism adaptable for feeding hydrated lime and other small size dry materials from storage bins and hoppers to elevators, conveyors, spouts and screens. Feeding is done by a spiral rotor of special design and provides a steady and continuous flow. It is equipped with an agitating hopper which is said to eliminate bridging and hanging up of materials being processed.

Feeder designed to feed hydrated lime and other small size materials from bins to elevators, screens and conveyors

Awards Under Walsh-Healey Act

CONSIDERABLE INTEREST has been manifested by the industry in the announcement of contracts awarded for ready-mixed concrete by various federal agencies. The tabulation on this page gives the names of the companies which have recently obtained contracts.

Mineral Fillers For Bituminous Mixtures

FOURTEEN different mineral fillers were subjected to the water-asphalt preferential test and compared for surface area and particle size distribution in the laboratory of the Michigan State Highway Department. Following are the conclusions drawn from those comparative studies:

Limestone fillers are in general finer than silica fillers.

Equal weights of silica and limestone fillers will carry the same requirements, which means that in the oil aggregate design consideration of volume weights does not apply.

Siliceous and argilaceous fillers are hydrophilic (water attractive) on the basis of the water-asphalt preferential test, consequently they may be detrimental for use in oil aggregate mixtures. In bituminous concrete and sheet asphalt, however, the higher viscosity of the asphalt probably compensates for this property. Whether the addition of small amounts of certain chemicals may correct the hydrophilic properties of certain fillers in oil aggregate mixtures is not yet known.

Calcareous fillers were hydrophobic (water repellant) and do not separate from the oil in the water asphalt preferential test. They should not have detrimental effects on oil aggregate mixtures exposed to wet weather conditions.

J. W. LATHERS of Rockford, Ill., has completed arrangements to open a new quarry at the north edge of Geneva, Ill., to serve farmers with agricultural limestone. Mr. Lathers has operated quarries in Ogle and De Kalb counties.

TEN STONE QUARRIES have been opened in Steuben County, New York, to give employment to 250 WPA workers during winter months. The project calls for the production of 30,500 tons of crushed stone to be used in the improvement of 34 miles of county road.

BYER CRUSHED ROCK CO., Kansas City, Mo., suffered a fire loss of $45,000, according to Louis Marino, president of the company.

ANCHOR GRAVEL CO., Cincinnati, Ohio has moved to a new location at Eastern avenue and Emerald Place, Cincinnati. A new plant has been erected.

Ready Mixed Concrete Awards

Award Date '38	Contractor or Source of Supply	Agency	Amount
10/6/36	Hofheimer Concrete Corp., Norfolk, Va.	WPA.Tr.Proc.	$ Indefinite
10/14/36	Golden Gate Atlas Materials Co., San Francisco, Calif.	WPA.Tr.Proc.	11,285
10/26/36	San Francisco Gravel Co., San Francisco, Calif.	WPA.Tr.Proc.	11,205
11/4/36	Golden Gate Atlas Materials Co., San Francisco, Calif.	WPA.Tr.Proc.	12,106
11/7/36	Consumers Rock & Cement Co., San Francisco, Calif. Chas. L. Harvey Co., San Francisco, Calif.	WPA.Tr.Proc.	12,506
11/20/36	Dolese Bros. Co., Oklahoma City, Okla.	WPA.Tr.Proc.	24,134
11/23/36	Makins Sand & Gravel Co., Oklahoma City, Okla.	WPA.Tr.Proc.	12,980
11/17/36	Gravel Products Corp., Buffalo, N. Y.	WPA.Tr.Proc.	14,750
12/1/36	John Cassaretto Co., San Francisco, Calif.	WPA.Tr.Proc.	11,005
12/11/36	Standard Roofing & Material Co., Tulsa, Okla.	WPA.Tr.Proc.	12,474
10/12/36	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	21,600
10/12/36	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	16,500
11/9/36	Hunterspoint Lumber & Supply Co., L. I. C., N. Y.	WPA.Tr.Proc.	12,900
10/9/36	General Sand & Stone Corp., Mamaroneck, N. Y.	WPA.Tr.Proc.	10,191
12/17/36	J. & O. O'Rourke, Inc., Flushing, L. I., N. Y.	WPA.Tr.Proc.	13,297
1/15/37	Colonial Sand & Stone Co., N. Y. C.	WPA.Tr.Proc.	10,010
1/14/37	C. W. Blakeslee & Sons, Inc., New Haven, Conn.	WPA.Tr.Proc.	22,484
1/14/37	Consumers Rock & Cement Co., San Francisco, Calif. Chas. L. Harvey Co., San Francisco, Calif.	WPA.Tr.Proc.	12,506
2/23/37	Transit-Mix Concrete Co., N. Y. C.	WPA.Tr.Proc.	28,200
2/4/37	Consolidated Rock Products Co., Los Angeles, Calif.	War Engineers	12,640
3/5/37	Roberts Paving Co., Washington, D. C.	Farm Security	57,450
3/3/37	Readymix Concrete Co., Ltd., San Francisco, Calif.	WPA.Tr.Proc.	11,605
3/5/37	John S. Hodgson & Co., Montgomery, Ala.	WPA.Tr.Proc.	Indefinite
3/17/37	Pioneer Sand & Gravel Co., Seattle, Wash.	Navy, S & A	58,875
3/20/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	21,300
3/13/37	Municipal Trucking Co., Mobile, Ala.	WPA.Tr.Proc.	Indefinite
4/9/37	Boston Sand & Gravel Co., Cambridge, Mass.	WPA.Tr.Proc.	55,000
4/9/37	Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.	WPA.Tr.Proc (IQ)	11,220*
4/19/37	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	10,650
4/19/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	10,725
4/29/37	Valentine Lumber & Supply Co., Springfield, Mass.	War Engineers	14,200
5/10/37	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	14,200
5/10/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	14,100
5/19/37	Readymix Concrete Co., Ltd., San Francisco, Calif.	WPA.Tr.Proc.	12,503
6/2/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	10,575
6/2/37	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	10,500
5/19/37	P. J. Keating Co., Fitchburg, Mass.	War Engineers	48,000
6/8/37	Watertown Builders Supply Co., Watertown, Mass.	WPA.Tr.Proc.	30,000
6/24/37	John Cassaretto Co., San Francisco, Calif.	WPA.Tr.Proc.	11,205*
6/23/37	Boston Sand & Gravel Co., Cambridge, Mass.	WPA.Tr.Proc.	43,750
6/28/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	14,200
6/28/37	Central Concrete Inc., Brooklyn, N. Y.	WPA.Tr.Proc.	13,700
8/18/37	Crosby Lighterage Co., Seattle, Wash.	Navy	38,050
9/13/37	Dravo Corp., Pittsburgh, Penn.	War Engineers	12,245*
9/29/37	P. J. Keating Co., Fitchburg, Mass.	War Engineers	14,400*
10/19/37	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	43,500
11/5/37	Central Concrete, Inc., Brooklyn, N. Y.	WPA.Tr.Proc.	42,050
11/30/37	Byrnes Conway Co., St. Bernard, Ohio	Farm Security	23,888
12/9/37	Hunterspoint Lumber & Supply Co., Inc., L. I. C., N. Y.	WPA.Tr.Proc.	18,000
12/9/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	18,075
12/8/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	14,380
12/8/37	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	21,690
12/15/37	Morris L. Hecker Co., Champaign, Ill.	WPA.Tr.Proc.	17,920*
12/31/37	Highbridge Concrete Corp., Bronx, N. Y.	WPA.Tr.Proc.	14,360
12/31/37	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	16,652
1/17	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	39,243
1/17	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	32,220
1/17	Highbridge Concrete Corp., N. Y. C.	WPA.Tr.Proc.	17,775
1/17	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	29,080
1/17	Hunterspoint Lumber & Supply Co., Inc., L. I. C., N. Y.	WPA.Tr.Proc.	33,950
1/17	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	72,200
1/17	Highbridge Concrete Corp., Bronx, N. Y.	WPA.Tr.Proc.	12,825
1/31	Roberts Paving Co., Salisbury, Md. Same at Norfolk & Portsmouth, Va.	WPA.Tr.Proc.	82,075
3/10	Geo. T. McLean Co., Inc., Portsmouth, Va.	Navy	92,200
4/15	DeBolt Concrete Co., Richmond, Ind.	WPA.Tr.Proc.	12,960
4/16	Coon Certified Concrete, Luzerne, Penn.	War Engineers	21,920
5/14	Colonial Sand & Stone Co., Inc., N. Y. C.	WPA.Tr.Proc.	17,472
5/17	J. P. O'Connell Co., Boston, Mass.	WPA.Tr.Proc.	16,200
5/31	Highbridge Concrete Corp., Bronx, N. Y.	WPA.Tr.Proc.	14,300
5/31	Transit-Mix Concrete Co., Inc., N. Y. C.	WPA.Tr.Proc.	16,967
6/1	Watertown Bldg. Supply Co., Watertown, Mass.	WPA.Tr.Proc.	26,292
6/1	J. P. O'Connell Co., Boston, Mass.	WPA.Tr.Proc.	36,796
6/1	Whittemore Co., Roslindale, Mass.	WPA.Tr.Proc.	28,622
6/10	Watertown Builders Supply Co., Watertown, Mass.	WPA.Tr.Proc.	12,455
6/10	Crystal Concrete Corp., Braintree, Mass.	WPA.Tr.Proc.	43,935
6/27	Ready Mixed Concrete Corp., Indianapolis, Ind.	WPA.Tr.Proc.	19,600
6/27	Ready Mixed Concrete Co., Kansas City, Mo.	WPA.Tr.Proc.	61,125
6/22	McPhail Fuel Co., San Rafael, Calif.	War Engineers	160,540
6/22	Bode Gravel Co., San Francisco, Calif.	War Engineers	49,290
6/28	Ready Mixed Concrete Co., Kansas City, Mo.	WPA.Tr.Proc.	17,910
6/29	Geo. T. McLean Co., Inc., Portsmouth, Va.	Navy	70,375*
6/29	Watertown Builders Supply Co., Watertown, Mass.	WPA.Tr.Proc.	42,851
6/29	Whittemore Co., Roslindale, Mass.	WPA.Tr.Proc.	47,543
6/29	Boston Sand & Gravel Co., Cambridge, Mass.	WPA.Tr.Proc.	39,473
6/29	J. P. O'Connell Co., Boston, Mass.	WPA.Tr.Proc.	54,131
7/5	Cadmac Material Corp., Brooklyn, N. Y.	WPA.Tr.Proc.	13,206
6/28	Ready Mix & Supply Corp., Tivoli St., Albany, N. Y.	WPA.Tr.Proc.	143,600
7/25	Pioneer Sand & Gravel Co., Seattle, Wash.	Navy	73,520
12/31/36	San Francisco Gravel Co., San Francisco, Calif.	War Engineers	34,280*
			$ 2,538,684

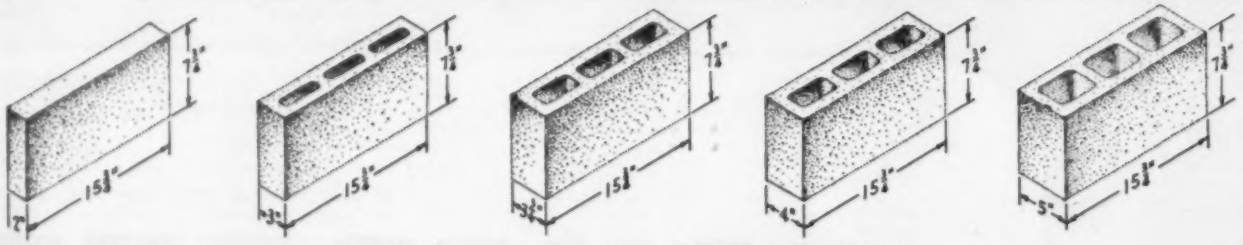
*Estimated.

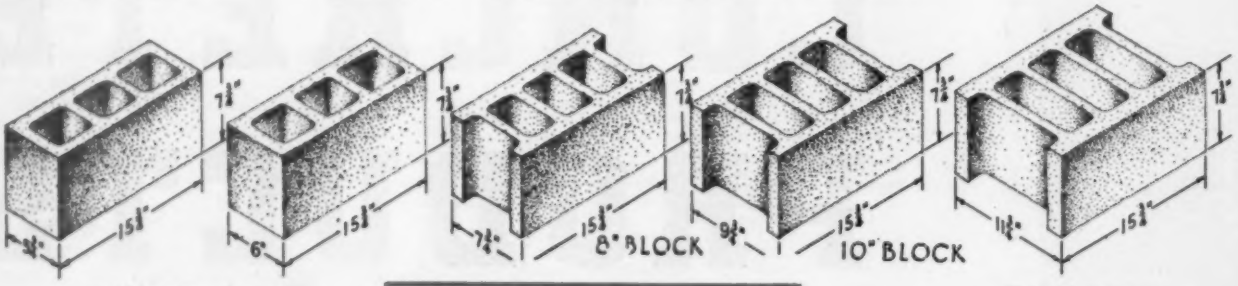
CONCRETE PRODUCTS and CEMENT PRODUCTS

BESSER PLAIN PALLET STRIPPERS

MOST ECONOMICAL IN FIRST COST AND IN OPERATION

Any Size Block, Tile or Brick Made on ONE SET of Plain Steel or Wood Pallets
THIS SAVING IN PALLET COST MORE THAN PAYS FOR A BESSER PLAIN PALLET STRIPPER



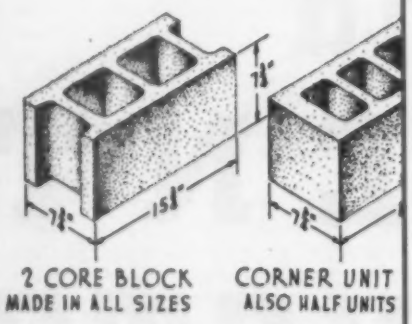


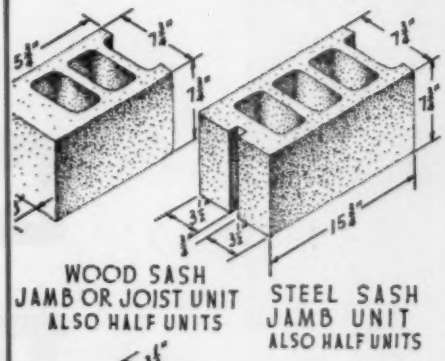
NEW ADDITIONS

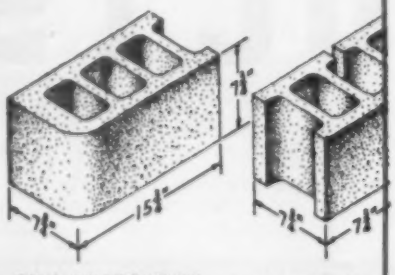
New additions to the famous Besser line of concrete products machinery are Vibrator Plain Pallet Strippers in small and medium capacities, and in Fully Automatic models with capacity up to 5000 blocks per day.

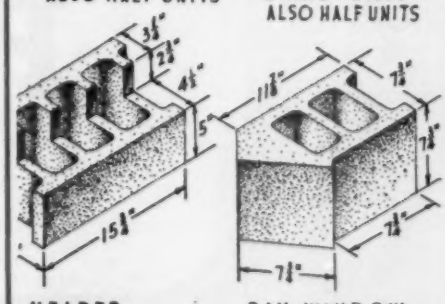
Besser Vibrator Plain Pallet Strippers are being made under original patents on the plain pallet principle. Vibrator features are under Flam patents, which have a record of nine years' success in the manufacture of vibrated blocks, and under other patents with equally successful records in vibration of concrete. Other patents pending.

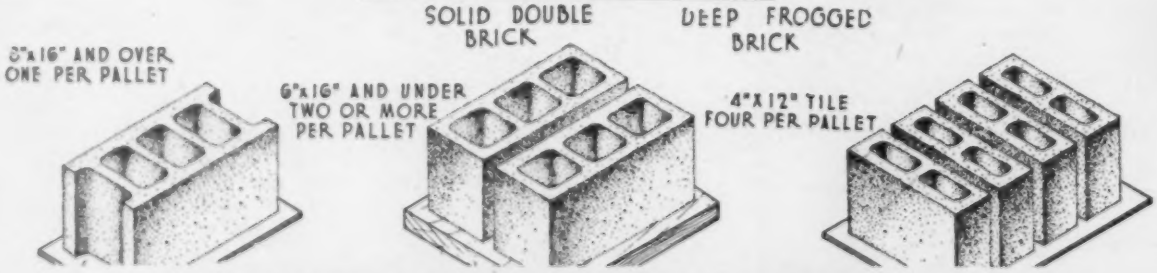
The latest in Both Besser Tamper and Vibrator Plain Pallet Strippers will be shown at the Concrete Industries Exposition at Hotel Sherman, Chicago, February 7, 8 and 9, 1939.











BESSER MANUFACTURING COMPANY

COMPLETE EQUIPMENT FOR LARGE OR SMALL CONCRETE PRODUCTS PLANTS

New Ideas In Concrete Increase Sales

By BROR NORDBERG

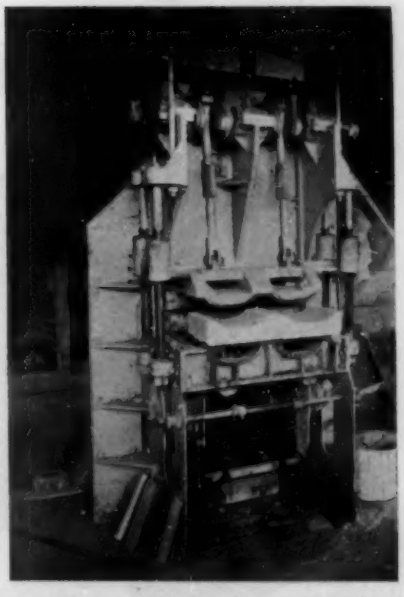
New products in precast concrete are constantly being introduced in various shapes and for various purposes. Some of them open up profitable sidelines for established concrete products manufacturers, others are adaptations from other products and some have possibilities in the larger markets and have put the inventor into the concrete products business. A few products will be described to illustrate some of the newer creations in precast concrete.

Precast Window Frame

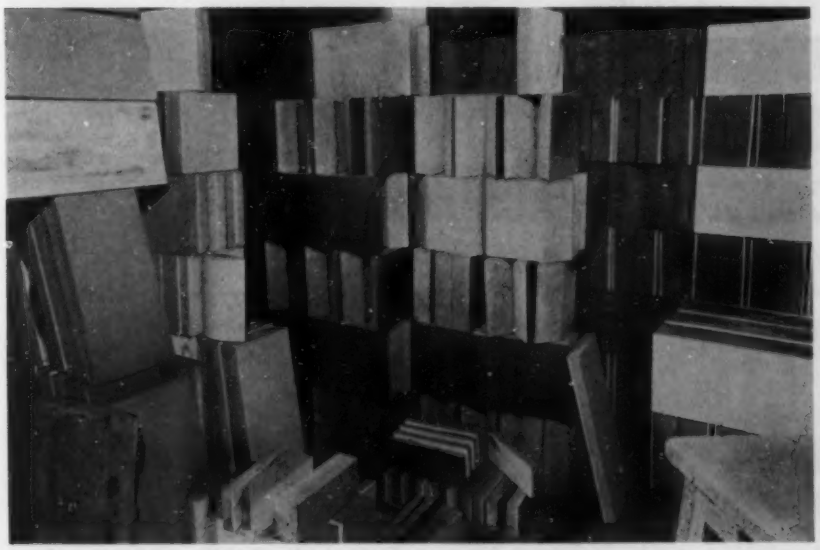
The "Livesay precast window unit," manufactured by the Livesay Window Co., Inc., Miami, Fla., is a good illustration of a concrete product that has wide application in modern home construction. The window unit consists of a precast concrete window frame, steel sash, window hardware, metal screens and Venetian blinds—the whole being individually constructed in the factory.

The window frames are cast in metal molds and vibrated on a high frequency vibrating table. The water-cement ratio is kept at a low figure and the mix consists of sand and fine stone, portland cement and water. On special order the frames are manufactured of Haydite aggregate and sometimes in imitation stone for special conditions. Reinforcing consists of two hoops of galvanized steel wire.

A number of advantages are claimed for the unit. The concrete frame is built in one-piece of dense concrete and the steel casements are fitted into them and caulked at the factory to eliminate water penetration when in place. The assembled units are delivered to the job ready to be placed in the wall by the mason. A number of economies are claimed for their use, mainly in time saved on the job for caulking, placing of sills, etc.



Machine developed for the manufacture of glazed surface concrete units. Before the pallet is placed in the machine the surfacing is vibrated in place on a vibrating table



Stockpile of glazed surface structural concrete units, which have application for exterior and interior construction. A variety of colors are kept in stock

Stockpile of concrete flagstones made by Yakima Cement Products Co., Yakima, Wash.

Glazed Surface Concrete

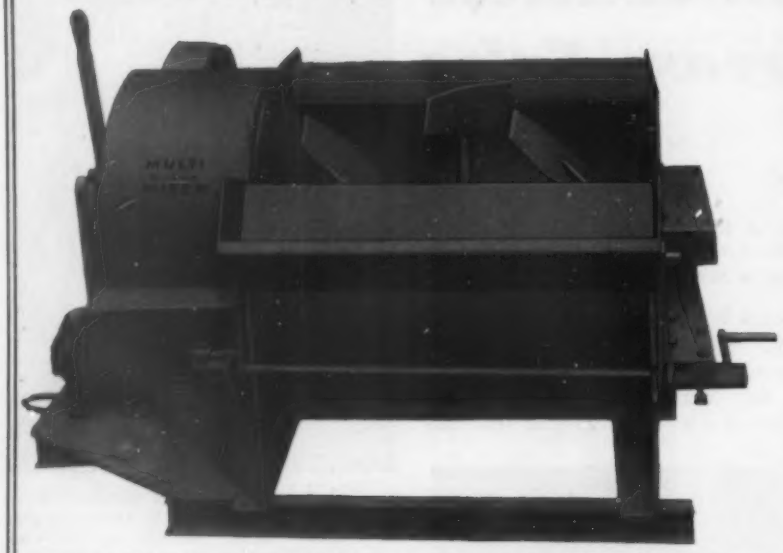
Another interesting development is a glazed structural concrete unit developed and sold in Pittsburgh, Penn., by the Glaze-Crete Corp. The surfacing consists of a mixture of mineral oxides of the desired color, white portland cement, stone sand and water or a prepared mix (Coloroc) is used. The surfacing of about 3/16-in. thickness is placed on stainless steel polished pallets and vibrated on a vibrating table about 30 seconds, after which the pallet is placed in a semi-automatic press and the backing concrete is placed.

The units are cored and made in 2- and 4-in. thicknesses and range in size from 2¾- x 11¾-in.to 23¾-in. x 11¾-in. The machine for their manufacture was designed by August De Giovanni, president of Glaze-Crete Corp. The coloring surface is washable and the units lend themselves to exterior as well as interior construction with unusual artistic possibilities for the architect.

Artistic Tile and Slabs

In response to a rapidly developing demand for color in architecture, Hansard and Sexton, Inc., Nashville, Tenn.,

MULTI-MIXERS *for a better mix*



More profits
Unusual performance
Longer life of the mixer
The safest mixer
Investigate our line
Many new features
Inclosed and fool-proof
X-tra value
Easy on power
Reverse action mixing
Sturdy in construction

The Multi-Mixers are now in use in a great many products plants since their first introduction a year ago. They will actually give a better mix in one-half the average time.

Multi-Mixers are built in sizes from 5 to 50 cubic foot capacities and can be had with belt, V-belt, or direct motor drive. See them at the Chicago Show in Booths 46-A, 46, 47, and 48.

THE MULTIPLEX CONCRETE MACHINERY CO. ELMORE, OHIO

"COMMERCIAL" CORED *Steel* PALLETS

Will not crack or break.

Lighter in weight than plain pallets.

Permit uniform and quick curing.

Makes sharp edges and deep mortar grooves.

Can be used on Low Cost Machines.

No weak places or core bar marks.

Better Ashlar and Header block production.

Close fit to core box.

Write us or your machinery maker.

The COMMERCIAL SHEARING & STAMPING COMPANY
YOUNGSTOWN, OHIO.

ROCK PRODUCTS

Reaches the Men Beyond Your Salesmen's Reach!

THE purchase of a piece of equipment in our industry requires the action of several executives, most of whom are too busy to see even your best salesmen. However, you can be sure of preferred consideration if your sales story appears in ROCK PRODUCTS, the paper which helps them in all their problems.

Be sure your 1939 advertising and sales campaign includes an adequate portion for ROCK PRODUCTS, The Industry's Recognized Authority.

ROCK PRODUCTS
205 WEST WACKER DRIVE
CHICAGO, ILLINOIS

Precast concrete window frame developed in Miami, Fla. The frame is of low water-cement ratio mix placed by vibration

has developed and is successfully merchandising a comparatively new line of colored concrete slabs and tile for residential and other classes of construction.

The units are vibrated in live rubber molds to give smoothness to the surfaces and variegated or smooth color effects. Tiles range in size from 3- x 3- x ½-in. up to 6- x 6- x ½-in. and from 6- x 6- x ¾-in. to 12- x 12- x ¾-in. Slabs are 24-in. square, two inches thick, and are load-bearing, to be placed on precast concrete joists in constructing floors. The coloring is a mixture of the desired mineral color, white silica sand, white portland cement and water which is vibrated in the molds and then backed with "Tuff-Lite" aggregate concrete and again vibrated.

The Lexington Concrete Products Co., Lexington, Ky., is manufacturing similar wall tile, floor tile and floor slabs by approximately the same process. A number of residences, theatres and other buildings have been built in both cities utilizing these slabs and tile wherever colors can add to appearance.

The rapidly developing market for concrete masonry home construction has been paralleled by a number of new designs of concrete units for which various advantages are claimed. Some of these block are still in the experimental stage and some are rapidly being accepted by architects and builders but they all illustrate the versatility.

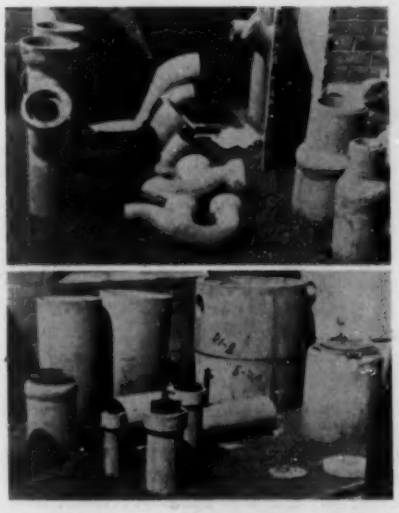
Mortarless Block

In Southern California has been developed a new machine and a type of blocks which are laid in a wall without mortar to produce hollow wall construction that is claimed to compare favorably in price with frame and stucco construction. The blocks have lugs cast into the bottom which fit into recesses in the blocks comprising the course below and the ends are beveled so that each block is completely interlocked with all adjoining blocks. The lugs center the blocks so that a wall consists of a series of vertical air spaces separated by the webs of the blocks. For additional strength the webs are filled with concrete at definite intervals along the walls, with ⅜-in. steel rods for reinforcement and to tie in with the footings and floor above for rigid reinforcement.

Asphalt-Dipped Block

An Eastern concrete products manufacturer has developed a new asphalt-treated backup block that is designed to compensate, by its resistance to water penetration, for deficiencies in the resistance to water absorption of various veneer surfaces.

New type of precast curb manufactured by vacuum process for use on New Jersey highways



Above: Assortment of pipe fittings in stock at Yakima Cement Products Co., Yakima, Wash. Below: Group of special units, including ash containers, septic tanks and pipe fittings

Metal ties inserted in a recess of each block, when laid up in a wall, extend about 2½ in. into the mortar courses in the veneer wall to give bond and added reinforcement to the entire wall. The blocks are manufactured with a split mortar surface on the top of each to give increased resistance to water penetration along the joints and each one is waterproofed by dipping in emulsified asphalt. They are manufactured at the rate of seven per minute on an automatic machine. Details will be described in a forthcoming issue of ROCK PRODUCTS.

Reinforced Concrete Channels

In Milwaukee, Wis., Fred W. Pfeifer, president, Wisconsin Units Co., has developed a reinforced concrete channel, manufactured on a pneumatic machine, that has wide flexibility in the construction, particularly, of low cost homes. "Pfeifer Units," as they are called, are made in 24- x 24- in., 12- x 24-in., and 12- x 12-in. sizes, each with two flanges 4-in. in depth on opposite sides. These channel sections are bolted together with the flanges vertical in laying up walls and to lightweight steel joists in placing floors and roofs. The wall when laid up and finished provides a vertical rib-type construction with a dead air space for insulation. Details were published in ROCK PRODUCTS, September, 1938, pp. 59-61.

A number of other developments of a more miscellaneous nature have taken place, such as the manufacture of concrete paving block to be used in New York tunnel construction. Another unique product made by the rather new vacuum process is a concrete "pill box" designed for fortification purposes. These

(Continued on page 90)

Vibration Is the Trend In Equipment

Vibrated concrete block and the introduction of production machines for their manufacture are the biggest single advance being made by the concrete products industry. High frequency vibration has worked well in the placing of monolithic concrete of low water-cement ratios and for manufacturing miscellaneous precast concrete products such as joists and slabs, so the movement toward the design of block machines to operate on that principle is a logical one. However, while the idea is not new, actual operation is, and time alone will furnish comparison of the quality of units so made with tamped block, which are still much in the majority.

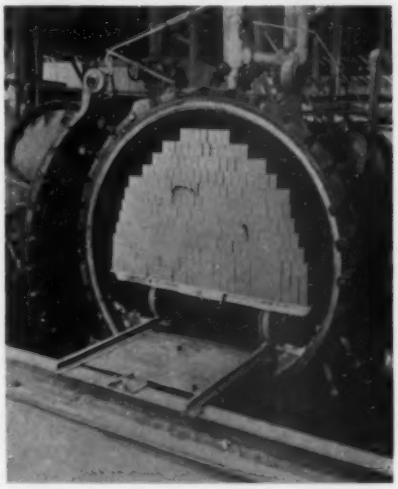
A lot of factors must be considered in any fair comparison of the two methods. Among them are: (1) Comparative compressive strengths when using various aggregates; (2) Distribution of aggregate and segregation; (3) absorption; (4) texture; (5) acoustical properties and nailability when using lightweight aggregate; (6) comparative costs of manufacture; (7) weight; (8) fracture of aggregate.

New Vibratory Machines

The answer to these questions and others will be had when more experience is gained and as machines are still further developed. Several types of vibratory machines are now in actual production and others are to be announced at the Concrete Industries Exposition to be held in Chicago in February. We will briefly describe the features of some of the machines.

An accompanying illustration shows a Stearns "Joltcrete" machine operating in the plant of Spickelmier Fuel and Supply Co., Indianapolis, Ind. This machine, which has already been described in ROCK PRODUCTS, is manufacturing nine 8- x 8- x 16-in. units of gravel or haydite concrete per minute. A semi-dry mix is being vibrated in the mold box at the rate of 3600 cycles per minute, using an amplitude ranging from 1/16-3/32 in.

Multiplex Concrete Machinery Co., Elmore, Ohio, has developed a new "Variable-Speed Multi-Vibrator Press." The frequency of vibration can be changed on this machine to give individual treatment in handling different materials to be vibrated. The "multi-variable-speed-vibration" is available as an attachment for use on other machines in actual use.

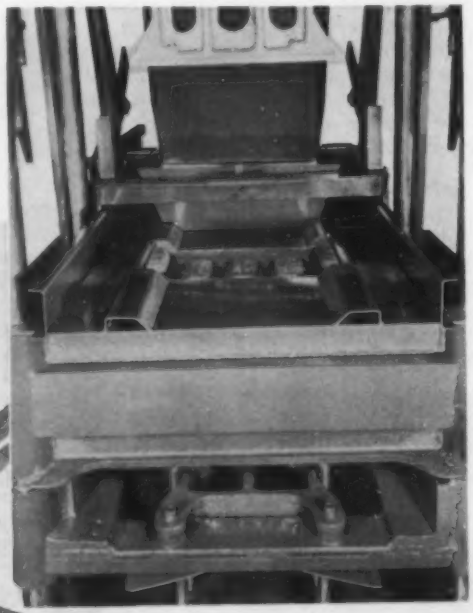


Curing concrete units in high pressure steam drums at the plant of Block and Brick, Inc., Detroit, Mich.

Besser Manufacturing Co., Alpena, Mich., is manufacturing a new machine designated the "Plain Pallet Vibrator Block Machine," which will be available in various capacities. The largest machine is fully automatic and will have a capacity of 560 standard concrete block per hour.

A combination of vibration and pressing is utilized to manufacture concrete block in the "Kent-Root Vibra-Press," announced by the Kent Machine Co., Cuyahoga Falls, Ohio. Vibration is confined within the mold box. After a period of vibration in the mold box, the flow of material from an overhead storage hopper is cut off at a predetermined amount above the final finished height of the block, leaving surplus material to be compressed into the exact unit size.

The mold box "floats" down under the pressing action exerted by the upper press to allow all material in the mold box to flow into place. The mold box is stripped upward to leave the finished block on the lower press head, and has a trowelling apron to trowel each unit while being stripped. The machine is designed to manufacture unit sizes up to 16- x 24-in. and 12 in. high.



Below: Block machine which manufactures units by vibration and compression up to 16- x 24-in. sizes and 12 in. in height

Above: Vibration takes place in the mold box and the material flow is cut off at a predetermined extra height to allow for compression

New small block machine which operates with a succession of hammer-like blows. A hydraulic lift, using city water pressure, strips the blocks

For smaller capacities, The J. B. Foote Foundry Co., Fredericktown, Ohio, has developed the "Hammered Stripper Block Machine," a machine that utilizes a ½-hp. motor and strips block by a hydraulic lift using city water pressure operated by a foot valve. The hammering action is done by a mechanical device with hardened steel cams acting on steel pins in the hammering plate at the rate of 7000 blows per minute. Capacity is 1000 units per day.

Curing

High pressure steam curing is a subject of much discussion. Its use for curing concrete block is not wide-spread, being confined mainly to those manufacturers who had the necessary equipment because of other interests, but the process of curing under steam pressures of 125 p.s.i. at 350 deg. F. has advantages. These manufacturers are making shipments 8- to 12-hr. after casting the block and are holding down yard inventories.

Favorable results can, of course, be had as well with low pressure steam curing and other methods, if units are properly made and adequate yard storage facilities are available. Fog curing is effectively used in some plants, where steam boiler equipment is lacking. In this process, small amounts of water are introduced into the kilns through vegetable sprays, or similar attachments, and the atomized moist fog permeates through the kilns. Several plants are supplementing this manner of curing, for winter operation, by forcing heated air by fan through the fog sprays, into the kilns. Individual fan-equipped hot air heaters are effectively used to do this.

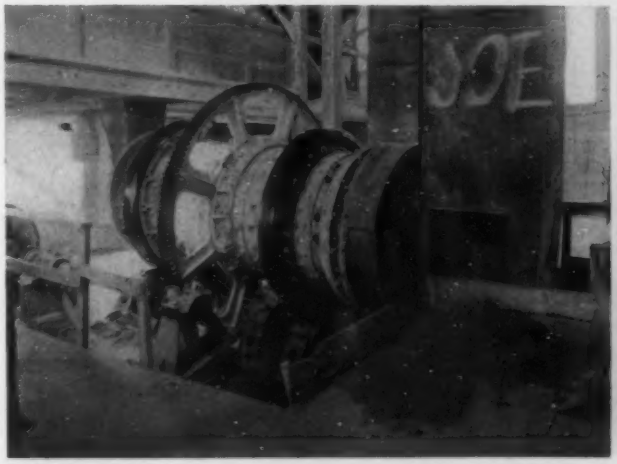
Handling of Cinders

There are various ways to crush and grade cinders for use in the manufacture of cinder block but we dare say, in the majority of plants, that too little attention is devoted to proper methods and to grading, which has a definite influence on product quality.

Compact crushing layout, consisting of a hammer mill followed by two sets of crushing rolls, used by Bennett Concrete Stone Co., Cleveland, Ohio

Spickelmier Fuel and Supply Co., Indianapolis, Ind., produces nine standard units per minute on this vibrating machine

An illustration of the new cinder crushing arrangement of the Bennett Concrete Stone Co., Cleveland, Ohio, has been selected to show a modern plant layout. Reduction is done in three stages consecutively. A belt conveyor, with magnetized head pulley to remove tramp iron, feeds a 16-in. New Holland hammer mill. The hammer mill has the ability to take a large clinker and reduce its size considerably. Following the hammer mill, the product passes through two sets of 16-in. double rolls, the upper ones with ribbed wearing surfaces and the lower ones smooth-faced. With this arrangement, neither crusher is required to make too great a reduction and abrasion caused by having too large pieces "ride the rolls" is reduced. Settings of each crusher are adjustable to vary the product size.



Left: Rod mill in the plant of Block and Brick, Inc., Detroit, used to crush cinders. Right: Partitioned measuring box used to proportion coarse and fine cinders into a mixer at the plant of Standard Concrete Products Co., Inc., York, Penn.

Incidentally, the manufacturer of the equipment recommends that hammer mill grate bars be spaced 2 in. apart to allow the free passage of 1-in. pieces of cinder without clogging, since cinders are usually wet.

Standard Concrete Products Co., Inc., York, Penn., uses two sets of rolls, making a separation of coarse from fine particles over a screen and recombines them to get needed fines in the concrete mix. The first reduction is to ¾ in. minus through 30-in. diameter by 12-in. rolls, followed by a long ageing period and then passage over a vibratory screen. Plus ½-in. cinders are reduced to ½-in. minus through corrugated New Holland rolls and recirculated over the screen. A ¼- to ½-in. product and a ¼-in. minus size are placed into separate bins. The vibrating screen cloth is the Cross, flanged-lip, perforated plate with ⅛-¼-in. and ⅜-½-in. openings. This type of screen opening has been effective in preventing blinding of the screen. The two sizes of cinders are drawn into a partitioned measuring box operated on rails to feed a 13-cu. ft. Stearns mixer. Crusher shells are segmented and readily replaced.

New Products

(Continued from page 85)

units have been demonstrated to the U. S. War Department at Washington, D. C.

Manufacturing Concrete Curbing

The vacuum process, developed by the Vacuum Concrete Corp., New York, N. Y., has been tried on a number of concrete products, some new and for special jobs, with interesting results. The process consists of utilizing suction pads to draw excess water out of the concrete immediately after placing.

In 1938, the process was used to manufacture a new type of precast concrete curb developed by the New Jersey Highway Department. The Department had a program to re-construct its main highways to provide a 16-ft. safety aisle in the center. The safety aisle is edged with a rather flat sloping concrete curb on which are a series of raised ribs intended to catch the headlights of auotmobiles to indicate the position of the curb to the driver. The Multiplex Concrete Co., East Orange, N. J., had a contract to furnish 70,000 ft. of curbing made by the process.

Precast concrete joists, while no longer a new product, have proven to be one of the greatest selling assets to the concrete products manufacturer who merchandises concrete masonry houses. The I-beam type with stirrup reinforcing projected upward to tie in with a poured concrete slab is the standard joist but several variations in design have been worked out for installation with filler block and precast slabs.

Other new products developed in recent years include drainage pipe of porous concrete construction using only coarse aggregate, self-centering concrete pipe, extremely light non-load-bearing insulating block, precast stairway treads and risers and many others. The limits of human ingenuity really determine to what extent and purposes the usage of concrete in precast form can be broadened.

Special Shapes In Concrete Blocks

Diamond Block Co., Miami, Fla., has developed a patented block known by the trade name as "Uanel". These units take their name from their resemblance in shape to the letters U and L. They were used for concrete columns and beams in the construction of a new factory building. These blocks, without the use of wood forms, make a hollow column in which the steel reinforcing rods rise and into which fresh concrete is poured, thus forming a solid column at a considerable saving in labor, lumber and time. For joists, U blocks are laid to form a hollow trough into which the steel is placed and the concrete is then poured.

Order Transit Mixers

Pfaff & Smith Building Supply Co., Charleston, W. Va., has recently installed four new 2½-cu. yd. Jaeger transit mixers on International trucks, and has ordered three more in the expansion of its ready-mixed concrete business. H. G. Truslow is manager. The company produces its own sand and gravel from two dredge operations in the Ohio and Elk Rivers.

Start Another Pipe Plant

Universal Concrete Pipe Co., Pittsburgh, Penn., recently started the construction of a concrete pipe plant at Somerset, Penn. It will be a single story building of concrete blocks, with a frontage of 60 ft. and a depth of 140 ft. The Universal company now has 12 factories in production, and operates in six states. L. C. Berkey Co., Somerset, Penn., is furnishing the block for the factory. Between 25 and 30 men will be employed in the new concrete pipe plant.

New Block Plant In Delaware

Delaware Concrete Products Co., Seaford, Dela., a new company, will soon start the erection of a $30,000 concrete block manufacturing plant. Capacity of the plant will be 50,000 block in 24 hours, according to the report. Either glazed or unglazed block or brick will be manufactured in many different colors. Modern high-pressure steam kilns will be built.

Walterboro Tile Co., Walterboro, S. C., has started the manufacture of what they call the Kay-O-More concrete building blocks. These blocks are said to be made by a new process which makes the product cheaper than clay brick. F. E. McKenzie, who will be in charge of the plant, hopes to be under full production early in January.

The Spokane Concrete Pipe Co., Spokane, Wash., obtained the contract to furnish concrete sewer pipe for the city on a bid of $58,000. The city will furnish a part of the materials and the WPA will supply the labor.

Part of new fleet of transit mixer trucks placed in service by Pfaff & Smith Building Supply Co., Charleston, W. Va.

Better Control Methods Improve R.-M. Concrete

By BROR NORDBERG

Ready-mixed concrete continues to lead the rock products industries in growth as evidenced by volume of business increase and in the number of new plants built. Most of the newer plants are small and simple in arrangement but some of the larger ones are of unusual and flexible design.

Plants that have been in operation a period of years have improved their facilities for control and are better equipped for cold weather operation, with devices which insure more uniformity in the delivered concrete. Designs of some of the newer and remodeled plants illustrate the direction which the industry is taking.

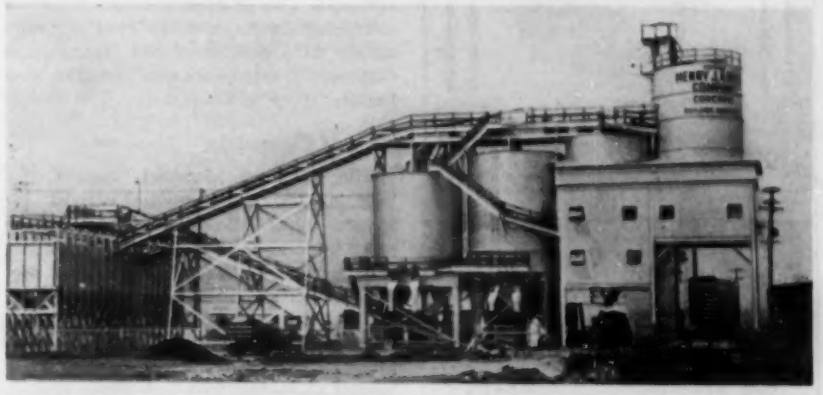
West Coast Plants

H. J. Kaiser Co., Oakland, Calif., completed a new ready-mixed concrete plant in Oakland in 1938 that is chiefly notable for its size and design. Cement and aggregates are received by rail. The cement is unloaded from one track to a hopper feeding a bucket elevator and the aggregates on another track to a hopper feeding a belt conveyor. The conveyor passes under the structure to truck loading bins, or from this conveyor to a parallel one leading back over the tops of the ready-mix plant bins.

As aggregate is received it is sent by the lower conveyor either to the detached truck bins where it is placed in the proper bin by means of a shuttle conveyor, or the first conveyor rising from under the ready-mix plant discharges to the second one leading back to the ready-mix plant bins. One of these bins (divided into quadrants) serves the batcher, the other two (also divided into quadrants) serve as storage bins, or as truck loading bins. To fill the ready-mix batcher bin from these storage bins the aggregates are drawn on to the original belt conveyor and hence back to the ready-mix plant. Air-operated gates are used. The whole plant is aluminum painted and quite striking in appearance.

Pacific Coast Aggregates, Inc., has just completed a new ready-mixed concrete plant near Colma in the southwest corner of San Francisco, and is moving its other San Francisco plant, the Golden Gate Atlas plant, to another location. The company also operates a large ready-mix plant in Oakland. Originally these were all batching plants serving transit mixers, but plant mixers are being added for pre-shrinking the transit mix charges.

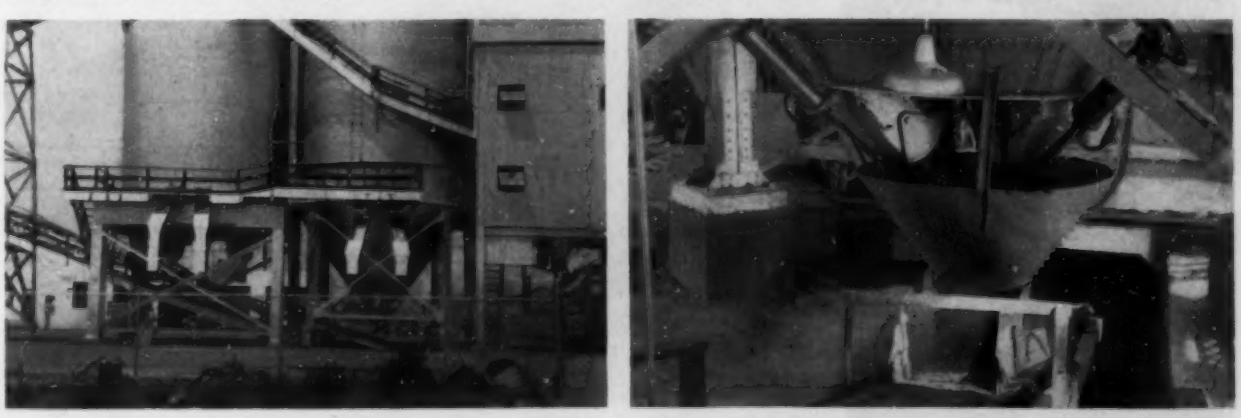
The Colma plant is built largely of equipment reclaimed from the Bay Bridge job and is of unusual design. It is on one of the main boulevards leading south from San Francisco near the coast, in a section which will undoubtedly be much built up in the next few years. The five steel bins hold three sizes of gravel and two of sand and are used for truck loading. Cement is handled by a Redler conveyor, and aggregates by a belt conveyor.



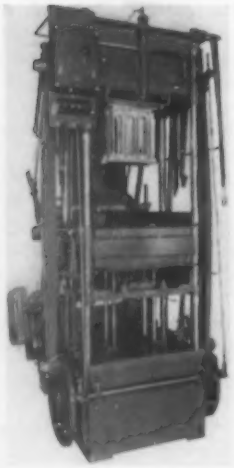
Plant built by H. J. Kaiser Co., in Oakland during 1938. Belt conveyors place aggregates into the bins on left and reclaim to the batching plant

Mix Control

A system of concrete design and control installed by Koenig Coal and Supply Co. in three plants in Detroit, Mich., was one of the really new developments made in existing plants the past year. Purpose of the system is to eliminate concrete failures due to faulty design and improper handling. Scientific Concrete Service Corp., Washington, D. C., originator of the system, operates on the theory that there is a correct amount of cement, no more or no less, for any



Left: Showing how aggregates are released from storage bins adjoining the batching plant through air-operated gates for transfer back into the bin serving the batcher. Right: Close-up of pneumatic cylinders used to release aggregates from bins



Announcing
The
KENT-ROOT VIBRA-PRESS

A new precision rapid production block machine. The latest in vibrating and pressing introducing new features of importance to all block men.

Write for information

THE KENT MACHINE COMPANY
Cuyahoga Falls, Ohio

We have specialized in the manufacture of concrete pipe equipment and concrete pipe for more than 16 years. This combination of mechanical theory and successful manufacturing practice has resulted in equipment which produces the finest quality pipe at a profit. It will pay you to investigate.

SEND FOR CATALOG

UNIVERSAL CONCRETE PIPE CO.
INCORPORATED
COLUMBUS, OHIO

Concrete mixes are being designed and catalogued for practically all construction purposes and mixes for special jobs are being recommended and for various placing conditions. The company is going further to the point of recommending methods of placing the concrete on specific jobs in order to derive the full benefit of a particular mix designed for that job.

Ready-mixed concrete plants are better equipped for year-around operation and more of them are fitted with equipment for heating mixing water and releasing live steam into bins and batchers. The heating problem has been simplified in some cities by the availability of a source of live steam from commercial steam-heating pipelines that happen to be in operation.

Winter Operation

The Builders Material, Inc., Cedar Rapids, Iowa, for instance pays for steam condensate delivered into the office building, where it is used for heating purposes. The condensate, at 212 deg. F., is delivered into the truck mixers at 180 deg. F. through insulated pipe by simply turning a hand valve. By taking advantage of this source of supply of heated water the cost of heating mixing water has been reduced by 75 percent. It might be that large industrial plants as well would be willing to sell steam condensate to ready-mix plants.

Live low pressure steam introduced into plant bins through jets is the common way to heat aggregates and to keep bin gates open at cold temperatures. that job. A detailed description of this development appears in ROCK PRODUCTS for December, 1938, p. 63.

Fred Schmitt Material Co., St. Louis, Mo., has a system to instantaneously heat mixing water. A low pressure boiler furnishes the steam to heat the mixing water, and for aggregates. Water is heated to 130 deg. F., the maximum allowed in the specifications, by instantaneous heating in the main from live steam in 1¼-in. diameter copper tubing. The length of tubing is calculated so that the required volume of water may always be drawn at 130 deg. F.

Delivery of Concrete

Graham Bros., Inc., Los Angeles, Calif., has worked out an arrangement to get the maximum service out of a truck mixer. The time factor per load is a variable cost figure which must be kept down, and this is done by keeping the mixer trucks busy all the time. Small jobs are quoted on a per cu. yd. delivered basis including a free standing time of 20 min. The customer receives a credit computed on a rate of $2.50 per hr. for any reduction from the 20-min. period and is charged for excess time on the basis of $2.00 per hr. The same principle applies for large yardage of concrete but credits and charges are computed on the total saving or loss of time on the job.

By trucking aggregates to a temporary transfer plant at the construction site, the Arrow Sand and Gravel Co., Columbus, Ohio, was enabled to furnish a 14,000-cu. yd. order on a special job without interference to deliveries being made to regular customers and without an increase in delivery equipment. Four transit mixers handled the concrete at rates as high as 56 cu. yd. per hr. where the entire fleet of 10 trucks would have been unable to maintain the peak schedule if hauled 6½ miles direct from the main plant.

New ready-mix plant of Pacific Coast Aggregates, Inc., at Colma (San Francisco), Calif. Steel bins on the right hold five aggregate sizes and are used for truck loading

Effective Sales Methods For Concrete Products

By RALPH S. TORGERSON

In the early days of the concrete product business very little thought was given to selling the product. Manufacturers had little capital or were engaged in the business merely as a sideline to other more profitable activities and, therefore, put all stress on production.

To meet this situation, particularly in communities where there has been very little construction using concrete products, it may be necessary to take architects and builders to other cities where homes and other structures are being built with concrete products.

"OK"
Say Architects of
CONCRETE BLOCKS
Interesting and different in its variation of treatment. Permanent, water-proof, crack-proof, vermin-proof building material surprisingly LOW in cost. Learn about Concrete Blocks before you build ANYTHING. Free estimates!
Central Pre-Mix Concrete Company
Concrete Products Division
N805 Division. Broad. 2156.
See a 'Rainbow' Supported by
Pre-Mix Concrete
Congratulations to the True's Oil Co. on the opening of its new Civic Center Super Service Station. Founded on such a solid foundation, it must give lasting satisfaction and service.
Prospective builders of similar structures are invited to talk it over with the—
Central Pre-Mix Concrete Company
N805 Division. Broad. 2156.
Find Out Why
Architects Recommend
PRE-MIXED CONCRETE!
Building materials used and recommended by architects are good materials to employ in your own building or remodeling. The quality or grade of concrete you will use is important. There are many "different" kinds. Find out why architects insist on PREMIX CONCRETE. Ask your architect, or consult the—
Central Pre-Mix Concrete Co.
N805 Division. Broad. 2156.

Typical examples of small newspaper advertisements used effectively in selling concrete products and ready-mixed concrete

This picture has entirely changed in recent years. The successful product manufacturer devotes his undivided attention to the business. New machinery has vastly increased productive capacity, reducing unit costs to a level where it is now possible for product manufacturers to compete effectively with other less durable types of construction. At the same time that costs have come down, the quality has gone up—another valuable sales argument.

One of the first steps necessary in planning a successful selling program is to recognize that the sales job must include not only the education of the prospective home builder but also the contractor and architect. Certain prejudices may have been built up in the minds of these three types of buyers which must be overcome. There is also a natural inertia against change found among those contractors or architects that have used materials other than concrete for above ground construction.

Model homes are a very effective way of bringing before the public the advantages of concrete house construction, but they do involve considerable cost, especially if only one product manufacturer undertakes the financing and promotion.

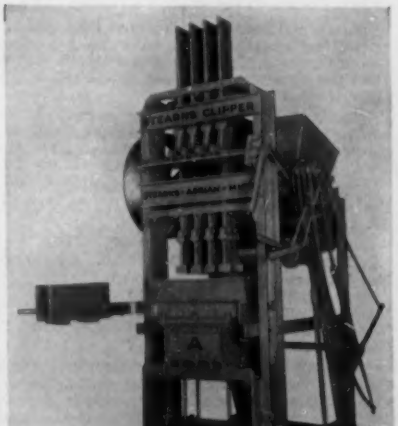
Model Sectional House Displays

Worrall Bros., Louisville, Ky., found that very much the same value could be derived from home show displays, in which a model of the front section of a house was erected to show the architectural possibilities and details of construction. This display at the last Louisville Home Show consisted of an English style front, 20 ft. wide, with a standard dimension doorway as an entrance for visitors. The end walls of the house extended back from the front about 10 ft. to give a finished appearance to the exterior. Around the front doorway, the wall was of random ashlar design, the chimney was of cinder concrete brick, and the remainder was of 8- x 8- x 16-in. cinder concrete units.

A large eastern manufacturer of cinder concrete block has an unusual sales set up. All sales are handled through a large local building supply dealer who carries a complete line of building supplies. This arrangement has made available a large, well-trained selling organization capable of giving much more thorough coverage than would be possible with an ordinary selling force.

The dealer has appointed one salesman, who handles cinder block exclusively, but the other men of the sales organization are interested and pro-

(Continued on page 100)



"ANCHOR"

Complete equipment for making concrete, cinder and other light weight aggregate units, including engineering service for plants and revamping of old ones for more economical service.

Hobbs block machines, Anchor tampers, Anchor Jr. strippers, Stearns power strippers, Stearns mixers, pallets, Straublox Oscillating attachments, etc.

Repair parts for Anchor, Ideal, Universal, Stearns, Blystone mixers and others.

Anchor Concrete Mchy. Co.

G. M. Friel, Mgr. Columbus, O.

CEMENT COLORS

RICKETSON'S
CEMENT COLORS
Since 1885
16 Standard Shades
"You can't Fade 'Em"
Write for samples & technical information
Ricketson Mineral Color Works
MILWAUKEE WISCONSIN

STAR and ANCHOR COLORS
Geo. S. Mepham Corp., East St. Louis, Ill.
C. K. Williams and Co., Easton, Penn.

Traffic and Transportation

PROPOSED RATE CHANGES—*The following are the latest proposed changes in freight rates up to and including the week of December 10:*

Central

56182. Establish on **crushed stone**, in bulk, and **agricultural limestone** (not ground or pulverized), in bulk, in open top cars, C. L., Osgood, Ind., to Bridgetown, Ohio, 116c per net ton, via B. & O. R. R.—Cincinnati, O. C. & O. Ry.

56206. Establish on **slag**, crushed, or crushed commercial, in open top cars, C. L., Jackson, O., to Delbarton, 165c, and Naugatuck, W. Va., 154c per net ton.

56236. Establish on **lime**, common, hydrated, quick or slaked, C. L., to Logan, W. Va. Proposed rates:

From	Min. Wt. 30,000 Lb.	Min. Wt. 60,000 Lb.
Northwestern, O., Group 1 (See Note)	19	15
Marble Cliff, O.	16	13
West Columbus, O.	16	13
Scioto, O.	17	15

Note—The points in Northwestern Ohio Group 1 are as follows: Bettsville, Carey, Genoa, Gibsonburg, Luckey, Maple Grove, Marblehead, Martin, McVittys, Narlo and Woodville.

56237. Establish on **crushed stone** and **crushed stone screenings**, C. L., in open top cars, North Vernon, Ind., to the following points in Indiana: Michigan Div.—Henderson, Ind., 88c; Knightstown, Ind., 94c; Marleville, Ind., 99c; Anderson, Ind., 105c; Alexandria, Ind., 110c; Fairmount, Ind., 116c; Marion, Ind., 121c. Chicago Div.—Lebanon, Ind., 110c; Indianapolis, Ind., 99c; Acton, Ind., 88c; McCoy, Ind., 72c; New Point, Ind., 77c; Morris, Ind., 83c; Weisburg, Ind., 88c; Lawrenceburg Jct., Ind., 94c. Columbus Branch—Ewington, Ind., 72c; Burneys, Ind., 77c; Hope, Ind., 83c; Columbus, Ind., 88c. Franklin & Martinsville Branch—Boggstown, Ind., 88c; Franklin, Ind., 94c; Trafalgar, Ind., 99c; Williams Crossing, Ind., 105c; Martinsville, Ind., 105c. Springfield Div.—Hunter, Ind., 105c; Maxwell, Ind., 99c; Wilkinson, Ind., 94c; New Castle, Ind., 99c; Mooreland, Ind., 105c; Losantville, Ind., 110c; Lynn, Ind., 116.

56258 (2). Establish on **crushed stone**, in open top cars, C. L., proposed rates (in cents per net ton).

To	From New Vienna, Ohio	From Hillsboro, Ohio
Barnesville, O.	160	171
Columbus, O.	105	116
Ironton, O.	127	116
Martins Merry, O.	171	182
Benwood, W. Va.	171	182

Route—Via B. & O. R. R., except to Ironton, O., route B. & O. R. R. to Bloom Jct., O., thence D. T. & I. R. R.

56287. Establish on **crushed stone** and **crushed stone screenings**, in open top cars, in straight or mixed C. L., Marble Cliff and Hite, O., to Valley Crossing, Groveport, Canal Winchester, Lockville, Carroll, Hookers, Lancaster, O., 60c per net ton to expire June 30, 1939.

56291. Establish on **slag**, crushed or crushed commercial, in open top cars, Jackson, O., to Delorme, 176c; Thacker and Vimy, W. Va., 165c per net ton.

56293. Establish on **crushed slag** or **crushed commercial slag** (other than granulated), in open top cars, C. L., Hamilton, O., to Columbus, O., 116c per net ton.

56295. Establish on **slag** (a product of iron or steel furnaces), in bulk, in open top cars, C. L., Cadillac, Mich., to Richmond, Ind., 176c per net ton.

56249 (1). Cancel following items of Agt. Kipp's Trf. 58-R applying on **limestone, agricultural**: Item 1040 and Item 1045, from Louisiana, White Rock, Hannibal, Mo., Marblehead and Quincy, Ill., to various points in Michigan, Ohio and Indiana. Item 1555, from Bettendorf, Ia., and Mobile, Ill., to Three Rivers, Mich. Item 1560 from Marblehead and Quincy, Ill., to Michigan City, Ind. Item 1960, from Aurora and Joliet, Ill., and stations taking same rates as shown in Item 210 of the tariff to Indianapolis, Ind., Cincinnati, O., Jeffersonville, Evansville, Madison, New Albany, Ind., Louisville, Owensboro, Henderson, Ky., and stations taking same rates as shown in Items 230 to 290, incl. Classn. basis to apply in lieu thereof.

56299. Cancel present rate on **stone**, viz., rough, rubble, rip rap (not dimension stone), C. L., Chicago, Ill., to Detroit, Mich., classification basis to apply.

56330 (1). To cancel present rates published in the following items of C. C. C. & St. L. Ry. Tariff 1733-J:

Stone and articles as described in Item No. 5—Items 350 to 365, from Alton, Ill., to various destinations in Illinois; Items 375 to 390, from E. St. Louis, Ill., to various destinations in Illinois; Items 395 to 410, from St. Louis, Mo., to various destinations in Illinois; Items 420 to 445, from Bellefontaine, Ohio, to various destinations in Ohio; Item 460, Louisville, Ky., to Muncie, Ind.

Stone, rip rap, rubble or quarry scrap—Item 485, from Bloomington, Ill., to Cleveland, Ohio; Items 500, 525, 555 and 580, from East St. Louis, Ill., and St. Louis, Mo., to Chicago, Highland Park, Mundelein, Niles Center, Ill., and Milwaukee, Wis. Item 550, stone, rip rap or rubble, from Alton, Ill., to Nameoki, Ill. Item 900, boulders, crushed, C. L., viz.: spalls or offals, from Ingomar, Ohio, to Cincinnati, Ohio. Item 915, limestone, broken, from Alton, Ill., to various destinations in Illinois. Item 940, rip rap or quarry scrap, stone, from Ludlow Falls, Ohio, to Hamilton, Ohio. Item 960, stone, crushed or ground, in bags or packages, from Ingomar, Ohio, to Franklin (Warren Co.), Ohio. Item 970, stone, rubble, from Champaign, Ill., to Hazelton, Penn., and similar rates in other individual lines' tariffs, Classn. basis to apply in lieu thereof.

56331. Cancel present rates published in C. C. C. & St. L. Ry. Trf. 1733-J, on **stone** and articles as described in Item 5, C. L., from St. Paul, Ind., to destinations in states of Iowa, Kentucky, Missouri, New York, Pennsylvania, West Virginia and Wisconsin, also to following points in Ohio and Illinois, either subject to basing book application or applicable on traffic destined beyond, viz.: E. Burlington, E. Clinton, E. Dubuque, E. Fort Madison, E. Hannibal, E. Keokuk, E. Louisiana, E. St. Louis, Quincy, Rock Island, Coster, Gardner, Kankakee, Mazon, Pekin, Peoria, Seneca, Ill., Bellaire, Martins Ferry and Youngstown, Ohio, Classn. basis to apply. Rates in effect from St. Paul, Ind., to destinations in Illinois, Indiana, Michigan and Ohio, except those shown above, to remain in effect.

56340. Establish on **stone** fluxing, furnace or foundry, molding or refractory, unburned, in bulk, C. L., Carey, Ohio, to Baltimore, Md., 320c per gross ton.

56341. Cancel present rate on **molding sand**, C. L., Willow Creek, Ind., or points in that group, to Duluth, Minn., Classn. basis to apply.

56342. Establish on **limestone**, ground or pulverized, unburnt, C. L., min. wt. 60,000 lb., Hannibal, Mo., and Marblehead, Ill., to Greenwood, Ind., 259c per net ton.

56346. Cancel commodity rate 154c per net ton on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding, silica), or **gravel**, C. L., Oxford, Mich., to Walkerville and Windsor, Ont., Item 300-B of Sup. 17, G. T. Ry. Sys. (lines West), Trf. 312-R, Sup. 12 I. C. C. A-2783, and similar rates published in other individual lines' tariffs. Classn. basis to apply.

56379. Establish on **sand**, all kinds, and **gravel**, in open top cars, C. L., Brown Siding, Ohio, to Westerville, Ohio, 94c per net ton, via B. & O., Columbus, Ohio, P. R. R.

56380. Establish on **sand**, all kinds, and **gravel**, in open top cars, C. L., Overpeck, Ohio, to Coshocton, 149c; Elyria, 160c; Hubbard, 193c; Medina, 160c; Orrville, 171c; Pomeroy, 160c; Wadsworth, 171c; Wellington, 160c, and Wellsville, Ohio, 193c per net ton.

56439. Establish on **slag** (refuse product of lead or zinc furnaces having no commercial value for the further extraction of metals), in open top cars, C. L., Federal, Ill., to Richmond, Ind., 176c per net ton.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Trunk

37181. **Slag**, C. L. (See Note 3), from Reading, Birdsboro, Pottstown, Swedeland and Topton, Penn., to Lennoxville and Sherbrooke, Que., 30c per 100 lb.

37238. **Quarry waste**, consisting of crushed or broken stone, grout and rip-rap stone, C. L., min. wt. 80,000 lb., from Ambluco, N. Y., to various points in New York and New Jersey, rates ranging from $2.75 to $3.30 per net ton.

37242 (increase). To cancel commodity rates on **lime, agricultural**, from Curtis Bay (Baltimore), Md., to various points in Trunk Line territory published in B. & O. R. R. Tariff I. C. C. 20889; on **lime, agricultural, chemical** and **land**, from Baltimore, Md., stations to various points on the P. R. R., T. P. T. Co., and W. B. & P. & L. R. R. published in B. & O. R. R. I. C. C. 22096, and on **lime**, C. L., from Baltimore, Md., stations to various Trunk Line points published in B. & O. R. R. Tariff I. C. C. 20792. Reason—No present or prospective movement.

37245. **Sand**, common or building (not blast, engine, fire, foundry, glass, moulding or silica), C. L. (See Note 3), from Forestport, N. Y., to Lockwood, N. Y., $1.76 per net ton, in lieu of present 6th class rate.

37268. **Sand** and **gravel** (other than ground or pulverized) in closed cars or in open top cars with tarpaulin or other protective covering; **sand**, naturally bonded molding, in open top or closed cars, C. L.

M-3895 (increase). To amend Item 8625 of Agent Curlett's Tariff I. C. C. A-573 by changing rate from Stafford, N. Y., to Frewsburg, N. Y., on **stone, crushed**, as described in the item now reading $1.10 to read $1.21. Reason—To correct tariff error.

(See Note 3) from Dover, N. J., to Paterson, N. J., $1.21 per net ton, in lieu of present 6th class rate 11c per 100 lb.

37271. **Slate,** crushed, dust and ground, C. L., min. wt. 50,000 lb., from D. & H. Ry. stations to Lawrence, Mass., 18c per 100 lb. in lieu of present 6th class rate 24c.

37272 (increase). To cancel commodity rate on **sand** (other than ground or pulverized or naturally bonded molding), and **gravel** in open top cars, without tarpaulin or other protective covering, C. L., from Long Island R. R. stations, 225—Hempstead, N. Y., to 230—Mineola-Garden City, N. Y., to D. L. & W. R. R. stations, 837—Syracuse, N. Y., and 840—Solvay, N. Y., rate $3.19 per net ton, published in D. L. & W. R. R. I. C. C. 23816. Reason—No present or prospective movement.

37273 (increase). To cancel carload commodity rates on **lime,** land, agricultural; building; chemical; crude; carbonate of, dried; carbonate of; ground, refuse; residium phosphate of residium, and limestone dust, ground, from C. R. R. of N. J., stations to points of destination on C. R. R. of N. J. and N. Y. & L. B. R. R., published in C. R. R. of N. J. Tariff I. C. C. G-2981, Items 30 to 260, inclusive, and 270 to 315, inclusive. Reason—No present or prospective movement.

37281. **Limestone,** ground, pulverized, broken or crushed, C. L., min. wt. 60,000 lb., from Pleasantville, N. Y., to Saylesville, R. I., $2.53 per net ton, in lieu of present sixth class rate 23c per 100 lb.

37310. **Asbestos gravel,** refuse or shorts, C. L., min. wt. 60,000 lb., from Danville, Sherbrooke and Warwick, Que., to Glendale, N. Y., 29c per 100 lb., in lieu of present rate 31c.

37312. **Limestone,** crude, fluxing foundry and furnace C. L. (See Note 3), from Howard, Penn., to Aliquippa, Penn., $1.39 per gross ton, in lieu of present sixth class rate 22c per 100 lb.

M-3900. **Granules, roofing** (consisting of crushed slate or crushed stone or made from clay or from silica sand or crushed slag), C. L., min. wt. 80,000 lb., etc., from Bound Brook, N. J., to the following points:

	(*)		(*)
Chicago, Ill.	$4.95	Lockland, O.	$4.25
Chicago Heights, Ill.	4.95	Cincinnati, O.	4.25
Milwaukee, Wis.	4.95	Louisville, Ky.	4.95
Cleveland, O.	4.25	Lockport, Ill.	4.95
Detroit, Mich.	4.25	Lowell, Ind.	4.95
E. St. Louis, Ill.	5.86	Madison, Ill.	5.86
St. Louis, Mo.	5.86	Marseilles, Ill.	5.49
Erie, Penn.	3.74	South Bend, Ind.	4.63
Franklin, O. (Warren Co.)	4.25	Vandalia, Ill.	5.81
Joliet, Ill.	4.95	Waukegan, Ill.	4.95
		Whiting, Ind.	4.95
		Wilmington, Ill.	5.49

*Proposed rates per net ton.

M-3901. **Granules, roofing** (consisting of crushed slate or crushed stone or made from clay or from silica sand or crushed slag), C. L., min. wt. 80,000 lb., etc., from Bound Brook, N. J., to Niagara Falls, North Tonawanda and Lockport, N. Y., $3.61 per net ton, in lieu of present rates.

M-3902. To establish on **granules, roofing** (consisting of crushed slate or crushed stone or made from clay or from silica sand or crushed slag), from Bound Brook, N. J., and Rutherford, N. J., to East Walpole, Mass., $4.05, Millis, Mass., $3.57, Stratford, Conn., $2.77, Lawrence, Mass., $4.13 and Fulton, N. Y., $3.40, min. wt. 80,000 lb., etc.

Southern

17956. **Sand and gravel.** Cancel, as obsolete, rates published in S. F. T. B. Tariff 388-A from Ellenton, S. C. Mileage commodity rates to apply.

17962. **Asphaltic limestone,** C. L. Establish 242c under Desc. Item 200 and 275c net ton on Desc. Item 205 of S. F. T. B. Tariff 225-C, from Cherokee, Colrock and Margerun, Ala., to St. Louis, Mo.

18052. **Slate,** crushed, ground or pulverized, C. L. Establish 500c net ton from points in Md., N. J. and Penn., to St. Mathews, Ky.

18079. **Sand,** C. L. Establish from Prestonburg, Ky., to Clinchco, Va., 121c; Clinchfield and Norton, Va., 143c; Dante, Va., 132c; Appalachia, Andover, Dorchester, Glamorgan, Imboden, Pardee, Stonega, Bundy and Imboden, Va., 154c; St. Charles, Va., 165c net ton.

18081. **Lime,** C. L. Cancel rates published in S. F. T. B. Tariff 38-L from Roberta, Ala., to Baltimore, Md., New York, N. Y., and Philadelphia, Penn. Class rates to apply.

Western

E-41-270. **Stone,** crushed, ground or pulverized, C. L. (See Note 2), but not less than 40,000 lb., subject further to min. wt. on limestone as provided for in Item 1455 of W. T. L. Tariff 111-I. (Rates in cents per ton of 2000 lb.)

From Alton, Ill., E. St. Louis, Ill., Hannibal, Mo., Quincy, Ill., St. Louis, Mo.,

White Bear, Mo.

To Colorado Points	Pres.	Prop.
Grand Jct.	1100	628
Delta	1140	652
Montrose	1140	676
Durango	1160	676

From Alden, Ia.

To	Pres.	Prop.
Grand Jct.	1100	608
Delta	1120	632
Montrose	1120	658
Durango	1140	656

From Louisville, Neb., Omaha, Neb., Weeping Water, Neb.

To	Pres.	Prop.
Grand Jct.	1060	578
Delta	1080	602
Montrose	1080	626
Durango	1100	626

From Carthage, Mo., Ft. Scott, Kan., Phoenix, Mo.

To	Pres.	Prop.
Grand Jct.	1060	578
Delta	1080	602
Montrose	1080	626
Durango	1100	626

E-155-7. **Fluorspar,** C. L., from Salida, Buena Vista and Riverside, Colo., to points tabulated below. Rates: Proposed—To establish the same rates as provided in Application D-155-4.

To	Present *Rate	Min. Wt.	Proposed †Rate	Min. Wt.
New York City, N. Y.	(1) 75	(3)	1254	(4)
Baltimore, Md.	(1) 70	(3)	1254	(4)
Bethlehem, Penn.	(1) 73	(3)	1254	(4)
Pittsburgh, Penn.	(1) 64	(3)	1122	(4)
Lackawanna, N. Y.	(2) 67	(3)	1122	(4)
Youngstown, Ohio	(1) 59	(3)	1122	(4)
Wilmington, Del.	(1) 73	(3)	1254	(4)
Philadelphia, Penn.	(1) 73	(3)	1254	(4)
New Orleans, La.	(1) 80	(3)	1012	(4)

* Rates in cents per 100 lb.

† Rates in cents per net ton.

(1) St. Louis combination.

(2) Chicago combination.

(3) 80,000 lb. to base points, 40,000 lb. beyond.

(4) Minimum weight 60,000 lb.

Sup. 1 to E-155-7. **Fluorspar,** C. L., from Salida, Buena Vista and Riverside, Colo., to New York, N. Y., Baltimore, Md., Bethlehem, Pittsburgh and Philadelphia, Penn., Lackawana, N. Y., Youngstown, Ohio, Wilmington, Del., and New Orleans, La. Proposed change—Refer to original application shown in Application Bulletin dated September 19, 1938, and substitute rate of $10.20 for $10.12 as the proposed rate to New Orleans, La.

E-41-271. **Sand,** Silica, C. L., min. wt. 50,000 lb., from Klondike, Mo., to Springfield, Ill. Rates, present, 198c per ton of 2,000 lb. Proposed, 187c per ton of 2,000 lb.

E-41-272. **Sand,** C. L. (See Note 3), but not less than 40,000 lb., from Muscatine, Ia., to Iowa City, Ia. Rates, present, 85c per net ton. Proposed, 60c per net ton.

E-41-273. **Sand and gravel,** C. L. (See Note 3), but not less than 90,000 lb. From Muscatine, Ia. To Davenport, Ia. Rates—Present, 59c per net ton. Proposed—41c per net ton, to expire with December 15, 1938. No switching charges to be absorbed at destination.

Illinois

6624-C. **Crushed stone, gravel and sand** (other than bank, glass, molding, silica, blast, core, engine, filtering, fire and furnace, foundry, grinding or polishing or loam sand), in open cars, not covered by tarpaulin or other protective covering, C. L., min. wt. 100,000 lb., from C. B. & Q. R. R. stations in Zones 1 (Aurora, Ill., etc.); 2 (Ottawa, Ill., etc.), and 3 (Spring Valley, Ill., etc.), in I. R. C. territory, to C. B. & Q. R. R. points in the Chicago switching district, Chicago to Congress Park, inclusive. (Rates per net ton.)

From	Pres.	Prop.
Zone 1	65	50
Zone 2	70	55
Zone 3	75	61

8439-6 (I. R. C.). **Sand** (except naturally bonded molding; ground or pulverized sand), in open top equipment, from Essex, Ill., to Rockford, Ill. Present—Classification. Proposed—$1.38 per net ton, November 21, 1938.

Intercoastal

962. **Sand,** in bulk, in min. lots of 1,000 net tons, W. B. Request to establish rate of $2.75 per net ton.

Southwestern

14351. **Asphalt,** El Dorado, Ark., etc., to Helena, Ark. To cancel rate of 17c per 100 lb. on asphalt, as described in Item 1150-A, Sup. 17 to S. W. L. Tariff No. 233-A, carload, from El Dorado, Ark., and points on the El Dorado & Wesson shown in Item 1150-A to Helena, Ark., permitting mileage scale, published in Item 1115-A, Sup. 17 to S. W. L. Tariff No. 233-A, to apply.

15214 (1) **Silica and silica flour,** Hot Springs, Ark., to Chicago, Ill. To establish a rate of 28c per 100 lb. on silica, crushed or ground, in bulk in bags; silica flour, in bulk in bags, straight or mixed C. L., min. wt. 60,000 lb, from Hot Springs, Ark., to Chicago, Ill.

15249 (1). **Slag,** Birmingham, Ala., to St. Martinsville, La. To establish rate of $2.77 per ton of 2000 lb. on slag (except ground open-hearth basic slag or basic phosphate slag), C. L. (See Note 1), except that cars loaded to visible capacity are charged for at actual weight when less than the stenciled or marked capacity, but in no case less than 40,000 lb., from Birmingham, Ala., and points taking same rates, as shown in Item 495 of S. W. L. Tariff 114-H, to St. Martinsville, La.

15250 (1). **Lime (calcium),** Limedale Spur, Ark., to Memphis, Tenn. To re-establish the 12c rate on lime, C. L., min. wt. 30,000 lb., from Limedale Spur, Ark., to Memphis, Tenn., that is scheduled to be canceled effective with Dec. 14, 1938.

NEWS of the month

Drop Anti-Trust Suit Against Two Cement Companes

TEXAS has dropped its anti-trust penalty suit against the Longhorn Portland Cement Co. and the San Antonio Portland Cement Co., both of San Antonio. The remaining defendants are Lone Star Cement Corp., Dallas; Southwestern Portland Cement Co., El Paso; Trinity Portland Cement Co., Dallas; and Universal Atlas Cement Co., Waco. Assistant Attorney General Victor Bouldin said the complaint had been withdrawn against the San Antonio concerns for several reasons, which were given as follows: the two companies had joined the Cement Institute only during the period when the NRA was in force; they were not parts of chains having northern and eastern connections; they are not defendants in the Federal Trade Commission case, and in 1913 when an agreed judgment was made in other cement proceedings the two San Antonio defendants were dropped for lack of evidence against them. The new petition of the state asks penalties from January 30, 1930, to November 12, 1938. Maximum penalties of $1500 a day were asked against Southwestern Portland Cement Co. and Trinity Portland Cement Co. The minimum penalty is $50 a day.

Refuse to Handle Foreign Cement

TEAMSTERS AND BUILDING TRADE UNIONS refused to handle 2000 bbl. of cement from Germany unloaded at the Oakland, Calif., docks. Their refusal was said to be due to a report that the cement would be sold at one dollar a barrel in competition with local cement selling at $2.25 per bbl. The building trades workers have agreed not to handle the product in construction work even if it was hauled to them.

Dust Case Dismissed

COWELL PORTLAND CEMENT CO., Cowell, Calif., has been freed from the contempt complaint in which it was alleged that the court's injunction had been violated by the company. The injunction of 1935 limited escape of dust to 2.25 tons per kiln stack or a maximum of 13.5 tons for six kilns. In the interim, the cement company replaced the six stacks with a central stack. The complaining ranchers, however, held that the 2.25 tons per stack limitation applied to the central stack while the attorney for the cement company held that the court's restriction of 13.5 tons tons covered the emission from the central stack. The court held in favor of the company. Since the suit was instituted, the cement company has installed $150,000 in dust arresting equipment.

Sand Company Operates Day and Night

THE LUTESVILLE SAND AND GRAVEL CO., Black Rock, Okla., is reported to be operating day and night. The plant is taking sand and gravel from Spring river, and trucks are being operated continuously, delivering material to the company's branch line, which connects with the Frisco railway. Capt. W. T. Kyger, manager, is reported to have said that the plant will operate steadily all winter on its present orders.

New California Quarry

ROBERTS ISLAND DREDGING AND IMPROVEMENT CO., Antioch, Calif., has started up a new quarry near this city. R. P. Easley, president of the company, has announced that 10 men will be employed under the direction of James Quinn as superintendent. A steam shovel is in operation, and bunkers and rock crushers are being installed.

Offers to Sell Quarry to County

THE STANDARD LIME & STONE CO., Fond du Lac, Wis., which operates properties at Valders, Knowled, Oakfield, and Quarry, Wis., proposes that Manitowoc county take over the crusher, steel bins, stone grinding plant, lime kilns, and buildings at Quarry, Wis. No price has been announced.

Increase Output of Magnesite

NORTHWEST MAGNESITE CO., Chewelah, Wash., recently started up its third kiln, necessitating the employment of 60 additional men, according to Earl A. Garber, general manager. This will be the first time since October, 1937, that three kilns have been in operation.

Rule Gravel Purchase Invalid

CONTRACT FOR THE PURCHASE of 30,000 tons of gravel by the Meigs County (Ohio) Commission has been ruled invalid by Prosecuting Attorney Manning D. Webster. According to state law, a purchase made by the commissioners amounting to $1000 or more must be held for 20 days unless all three commissioners concurred. The law also requires that before a purchase can be made, the auditor must certify that funds are available. As only two of the commissioners had voted in favor of the contract and the auditor had not certified that funds were available, the prosecuting attorney held the contract to be invalid. The gravel contract was made with the Carpenter Sand and Gravel Co. on a bid of 85½c a ton.

New Company Takes Over Gastonia Quarries

THE GASTON STONE AND GRAVEL CO., Gastonia, N. C., is the name of the new corporation which has bought out the old Gastonia Quarries, Inc., south of the city. Operations have been started, and the company is now prepared to furnish crushed stone and gravel in all sizes. Glenn Pearson is president.

Recovering Dust from Kiln Stack Gases

OKLAHOMA PORTLAND CEMENT CO., Ada, Okla., will install equipment for recovery of dust from kiln stack gases. Each of the two kilns will have three Norblo separators 12 ft. in diameter. The installation will be completed some time after the first of the year.

Buy Indiana Rock Wool Plant

THE SUPERIOR ROCK WOOL CO., Largo, Ind., has been purchased by the Therminsul Corp., Kalamazoo, Mich. This plant was constructed in 1936, but was never placed in operation although it is reported to have a capacity for very large production. The Therminsul Corp. plans to open the plant soon with a force of 50 men. In addition to the usual insulation, the company will make sound-proofing products. There are now five rock wool plants operating in Wabash county.

Higher Rates for Mississippi Sand

SAND AND GRAVEL SHIPPERS of Mississippi lost their fight before the Interstate Commerce Commission to keep the lower intrastate rates in effect when the commission ordered the intrastate rates to be brought into line with the interstate rates. Twenty-five percent of the gravel used in the state moves by rail from commercial pits, according to the commission, and 75 percent moves by truck from wayside pits within 35 miles of the job. The interstate rates are from 30 to 60 percent more than the intrastate rates. Two commissioners dissented from the majority decision, and expressed the belief that the railroads would soon ask for reduced rates again to meet truck competition.

Chalk Rock Quarry for South Dakota

SOLOMON CRUSO, representing interests in New York, has announced that a chalk rock manufacturing plant will be opened in the Spring a few miles northwest of Menno, S. Dak. It is reported that there are large deposits of chalk rock at this location. Several years ago chalk rock was taken from a quarry in the Menno field by the Menno Farmstead Manufacturing Co. for use in making a commercial hog feed.

Asbestos Exhibit at New York Fair

JOHNS-MANVILLE CORP., New York, N. Y., has started to install exhibits in the new $4,000,000 asbestos hall, the first privately owned building completed at the New York Fair. The display will present the story of building materials, latest methods of heat conservation, and the harnessing of motion of motor vehicles and industrial mechanisms.

JOHNS-MANVILLE CO. has announced that its new factory at Jarrett, Va., specializing in insulating board, will be open early in 1939. The Watson, Calif., plant has begun production of rock-wool and transite asbestos-cement pipe, and the Richmond, Ind., plant will turn out stone felt, a recently developed insulation for mechanical refrigerators, railroad cars, automobiles and airplanes.

Social Security Wage Record

UNIVERSAL ATLAS CEMENT CO., New York, N. Y., has announced a new service for contractors in the form of an improved Time Book, embodying a complete office, field and Social Security wage record. This new 48-page book is said to have all the information a contractor needs to keep his time and wage records and Social Security data as to taxes, tax deductions and tax exemptions.

Puerto Rico Cement Mill Starts Production

OPERATION HAS STARTED at the government-owned Puerto Rico cement plant completed in October, 1938. The final cost is said to have exceeded original estimates, and the time taken to place the mill in operation extended several months beyond early expectations. Before the new plant was placed in service, all cement had been imported. Prices for this cement had not been high as the freight rates were low, the cement taking a ballast classification. The complete story about this new cement plant appeared in the June, 1938, issue of ROCK PRODUCTS.

Diversifies Activities

HILLTOP BUILDERS SUPPLIES CO., Cincinnati, Ohio has greatly diversified its activities. In addition to a substantial sand and gravel business and other builders' supplies, the company makes concrete products and sells ready-mixed concrete.

Eighteen Rex 2½- to 4-cu. yd. transit mixers are mounted on Mack and Ford chassis to supply ready mixed concrete.

In the accompanying illustration is shown the ready-mixed concrete plant. The structure is a concrete silo 33 ft. in diameter and 75 ft. high. To the right is shown a bucket elevator, 122 ft. centers, which carries all the aggregates to the six bins, four of which hold 2000 tons each, and two steel bins that hold fine aggregates for black top. There are also two compartments in the main silo that hold 600 bbl. of bulk cement. The silo was designed by Otto Epp, president and treasurer of the company, and was built by Morgan Engineering Co.

Inside the silo is a passenger elevator that gives access to any part of the structure. There is also a 2-cu. yd. Ransome mixer for central mixed concrete.

Concrete silo provides facilities for ready-mixed concrete, sand and gravel storage, and bulk cement

Lose Gravel Contract With City

THE BROWN-ROSENBARGER GRAVEL CO., Indianapolis, Ind., is reported to have lost its contract with the city of Battle Creek, Mich. A contract signed with the firm last October 18 called for delivery by November 15 of 6000 cu. yd. of ordinary gravel, 3000 cu. yd. of stabilized gravel (containing clay and calcium chloride) for black-topping, and 6000 cu. yd. of sand. It is alleged that by November 15, only 2946 cu. yd. of ordinary gravel and 2274 cu. yd. of sand had been delivered. The city claimed that 500 cu. yd. of stabilized gravel did not contain clay and calcium chloride as specified in the contract. The price of the gravel specified in the contract was 85c per cu. yd. for stabilized, 80c for ordinary, and 40c for sand.

Green Bay, Wis., Reports Larger Cement Receipts

CEMENT RECEIPTS by water at Green Bay, Wis., for 1938 showed a gain of about 7800 tons over last year, the total for this year amounting to 32,000 tons. Crushed stone gained about 16,000 tons, the total for the year approximating 50,000 tons compared to 23,771 tons in 1937.

Temporary Shut Downs in Cement Industry

DEWEY PORTLAND CEMENT CO., Dewey, Okla., has closed its plant here for the annual period for repairs to buildings and equipment.

GREAT LAKES PORTLAND CEMENT CORP., Buffalo, N. Y., shut down its kilns at the close of December with bins full.

FEDERAL PORTLAND CEMENT CO., INC., Buffalo, N. Y., has taken out of production the kiln it has operated all summer at its Hamberg turnpike plant. Although the kiln shut down early in December, the finish grinding mills continued to operate until the end of the month.

THE LONE STAR CEMENT CORP., Spocari, Ala., has temporarily discontinued production of Warrior brand portland cement with bins full. This plant has been in full operation since July. It is hoped to resume production at an early date.

FINANCIAL NOTES

RECENT DIVIDENDS ANNOUNCED

Arundel Corp.	$ .25	Dec. 27
Arundel Corp., extra	.50	Dec. 27
Crystalite Products Co., pfd.	1.50	Dec. 20
Crystalite Products Co., initial payment on junior shares	.15	Dec. 20
Diamond Portland Cement.	.65	Dec. 10
Florida Portland Cem., 7% pfd. Arrears Dec. 29, 1938, $75.25	3.50	Dec. 28
Ideal Cement Co.	.35	Dec. 21
Ideal Cement Co., Christmas div.	.35	Dec. 21
Longhorn Portland Cem.	.50	Dec. 29
Monarch Cement Co.	2%	Dec. 17
Monolith Portland Cem., pfd. Arrears Dec. 16, 1938, $2.95	.50	Dec. 15
Monolith Portland Midwest Co., pfd.	.25	Dec. 15
Pacific Portland Cem., 6½ pfd. (on acc't of arrears)	1.00	Dec. 28
Pennsylvania Glass Sand	.50	Dec. 20
Pennsylvania Glass Sand, pfd.	1.75	Jan. 1
Santa Cruz Portland Cem.	.50	Dec. 28
Signal Mountain Portland Cem., pfd. Arrears Dec. 22, 1938, $58.00.	8.00	Dec. 21
Superior Portland Cem., cl A	.55	Dec. 24
U. S. Graphite Co.	.25	Dec. 20
Yosemite Portland Cem.	.10	Jan. 2

NATIONAL GYPSUM CO., Buffalo, N. Y., directors have adopted an employes' stock purchase plan for the purpose of permitting employes, including officers, the right to purchase 100,000 shares of company's common stock over a period of five years. Each employe may apply for any number of shares but not exceeding the number equal at the price for the first year of $15 per share to 50 percent of the amount of his yearly salary from the company. Desire to participate in the plan had to be expressed before December 15, 1938, after which date the directors allocate the 100,000 shares in such manner and amounts as they deem best. After the first year the directors determine annually the price to be paid for the stock.

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UNITED QUARRIES, INC., Winfield, Penn., is offering 56,500 shares of capital stock at $3.37½ per share through Ray, Johnson & Co., Sunbury, Penn., to residents of Pennsylvania only. The company was incorporated in Pennsylvania August 1, 1938, and operates a limestone quarry in Union township, Union county, for production of crushed and pulverized stone. Annual production reported by the previous partnership: 1932—in tons —74,999; 1933—50,716; 1934—126,685; 1935—19,335; 1936—95,977; 1937—101,377. The authorized capital stock is 200,000 shares, par value $1. Fixed assets were reported as of August 24, 1938, as $111,031; leaseholds, $79,638; current assets, $21,413 (cash), $25,416 (inventory); the paid in surplus was $149,997. The officers are R. L. Smith, president; L. A. Smith, vice-president, and treasurer; S. B. Wolfe, secretary.

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PACIFIC PORTLAND CEMENT CO., San Francisco, Calif., called a special meeting of stockholders for December 19 to act on a recapitalization plan, the essentials of which were as follows: A $6,000,000 write-down of assets, reduction of common stock value to 13 percent of the present book figure, capitalization of accumulated dividends on preferred stock and retirement of outstanding preferred shares.

Under the plan $50 par value of 6 percent 20-year debentures and 5 shares of new $20 par value common stock would be exchanged for each share of present 6½ percent $100 par preferred and $39 preferred dividend arrears as of the close of 1938.

Holders of $100 par common stock now outstanding would receive 0.65 of a share of new $20 par common stock for each old $100 par share.

Assets would be written down $6,013,000 by writing off $3,166,000 carrying value of oyster beds, adding $1,550,000 to plant depreciation and writing off $1,297,000 from idle plants and other properties.

For the plan to be approved assents were required from 75 percent of preferred and a majority of common stock. Non-assenting preferred, it was provided, will remain outstanding with arrearages and would be subject to retirement at 105 and accrued dividends.

John D. McKee, vice-president and a director, opposed the plan in a letter to stockholders because, among other reasons, it would create a bonded indebtedness ahead of the stock interests; because it would in effect withdraw $3,000,000 of the assets of the corporation to pay now to the stockholders the entire present market value of their preferred stock.

The plan for recapitalization proposed by the company failed to carry at the stockholders' meeting. The vote was in favor of Mr. McKee's resolution to have appointed a special stockholders' committee to study out another plan.

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VOLUNTEER PORTLAND CEMENT CO., Knoxville, Tenn., retired $50,000 of its First Mortgage bonds, due 1942, on December 15, 1938.

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ARUNDEL CORP., Baltimore, Md., (sand, gravel and contracting) reported for 11 months ended November 30, 1938, profit of $1,242,256 after depreciation and expenses, but before federal income tax, comparing with profit of $1,060,162 in first 11 months of 1937. Current assets as of November 30, 1938, amounted to $3,557,219 and current liabilities were $496,889, comparing with $3,168,028 and $828,999, respectively, on November 30, 1937.

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STANDARD SILICA CORP., Chicago, Ill., reported earnings for the nine months to September 30:

Gross profit after depreciation and depletion	$43,303
General expenses	33,174
Operating profit	10,129
Other income	1,599
Total income	11,728
Federal income taxes (est.)	1,759
Net profit	9,969
Earned per share (128,952 shares)	$0.08

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HANFORD MACNIDER, president of the Northwestern States Portland Cement Co., Mason City, Iowa, recently appeared before a subcommittee of the Senate studying industrial profit sharing plans. Mr. MacNider expressed disapproval of both incentive taxation and punitive taxation as a matter of principle. He feared that incentive taxation might develop a trend among employers toward lowering wages to a minimum so that they could charge, for tax purposes, as large an amount as possible toward profit-sharing.

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THE MATERIAL SERVICE CORP., Chicago, Ill., is reported to have paid $225,000 cash for the Riverside Lime and Stone Co., properties in Lyons, Ill. The property also includes a railroad right-of-way to the main line of the Santa Fe.

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TISHOMINGO CONCRETE PIPE CO., Tishomingo, Okla., is now owned in its entirety by Chas. T. Bates, prominent Ada, Okla., oil man. Mr. Bates started the plant a year ago but had recently sold his interests to W. J. Ehlers and Lee Haris. The recent sale gives Mr. Bates sole ownership.

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ROCKPORT STONE, INC., Bluffton, Ohio, has been named in a petition for a receiver filed by three creditors.

Prices Bid—Contracts Let

WAHOO, NEB.: A. J. Ladenburger, Morse Bluff, Neb., was awarded a contract for approximately 800 cu. yd. of gravel for patrol 21026, Colfax and Dodge counties, with a bid of 96c per cu. yd. His bid of 74c per cu. yd. on 1900 cu. yd. for patrol 21035, Saunders and Lancaster counties, also was low.

SAN ANTONIO, TEX.: James Donaldson, Inc., San Antonio, was awarded the contract to furnish the city with cement for the remaining six months of the fiscal year on a bid of 64¼c a sack in C.L. lots delivered on city switch tracks with a 2½c discount per sack on bills paid within 15 days. Cloth sacks were specified. The firm agreed to supply cement in paper sacks at 58½c. Uvalde Rock Asphalt Co. was awarded the contract for cold mixed asphalt on a delivered price of $3.84 a ton and Rodgers and Stewart for fluxed rock asphalt on a delivered price of $5.24.

PORTSMOUTH, OHIO: Portsmouth Sand & Gravel Co. submitted the low bid on 1500 tons of washed sand and 3000 tons of washed gravel to the city of Portsmouth. It bid 93c a ton on the sand and $1.00 a ton on gravel.

MCARTHUR, OHIO: H. H. Swaim signed a contract with the county commissioners to mine and remove native gravel from a pit in Swan township for three years at 5c per cu. yd.

YAKIMA, WASH.: Homer G. Johnson was awarded the contract for 125,000 tons of sand and gravel to be used in the construction of the Roza canal. The Johnson bid was $65,350, the contract calling for 66,000 tons of sand and 59,000 tons of gravel.

WASHINGTON C. H., OHIO: Bids on 9000 tons of No. 4 and No. 46 crushed stone were received by the county commissioners, the low bidders for each township being announced as follows: Walnut Hills Quarries, for Concord, 700 tons of No. 6, $1.50 and No. 46, $1.30; Walnut Hills Quarries, for Green, 800 tons of No. 6, $1.45 and No .46, $1.25; Sugar Creek Quarries for Jasper, 800 tons of No. 6, $1.65 and No. 46, $1.45; Sugar Creek Quarries for Jefferson, 1000 tons of No. 6, $1.75 and No. 46, $1.55; Blue Rock Quarries for Madison, 1700 tons of No. 6, $1.75 and No. 46, $1.55; Sugar Creek Quarries for Marion, 100 tons of No. 6, $1.65 and No. 46, $1.45; Sugar Creek Quarries for Paint, 700 tons of No. 6, $1.75 and No. 46, $1.55; Blue Rock Quarries for Perry, 1000 tons of No. 6, $1.45 and No. 46, $1.25; Blue Rock Quarries for Union, 1200 tons of No. 6, $1.60 and No. 46, $1.40; Garringer Quarries for Wayne, 1000 tons of No. 6, $1.55 and No. 46, $1.35.

CROWN POINT, IND.: Illinois Slag and Ballast Co., with a low bid of $2.24 per ton was awarded the contract to furnish Lake county with 50,000 tons of slag to be used in ballasting roads in a recently approved construction program.

OSHKOSH, WIS.: Courtney & Plummer Co., has been awarded a contract by the county highway committee to crush 5000 cu. yd. of stone in the Wells quarry at 88c a cu. yd., and Lampert & Lampert Construction Co. has been awarded a contract to crush 5000 cu. yd. of stone in the Mathison quarry near Winchester at 87c a cu. yd.

Gypsum Plant to Open About March 1

NATIONAL GYPSUM CO., Buffalo, N. Y., has announced through President M. H. Baker that the new Savannah, Ga., plant will begin production about March 1. At a recent dinner in Savannah held in his honor, President Baker said that the new plant will begin production at 50 percent of its capacity, and that it will be rapidly increased until its full capacity will be reached within two years. Gypsum rock is now being stored in advance of the plant opening. The main plant building will be 100- x 750-ft.

STRENGTH · ELASTICITY · FLEXIBILITY · TOUGHNESS · DURABILITY

Determination is Still the Driving Force to Achievement

"Suddenly Galileo dropped the two shots of different weights and" . . . his idea, the daily used law of falling bodies, had been proved. Galileo's will to achieve had again won out.

The WILL to produce

"HERCULES" (Red-Strand) Wire Rope is the result of our long and steadfast determination to produce a product of the very highest quality. That was one of the original Leschen principles, and today — throughout our entire organization—there is keen satisfaction . . . sincere pride . . . in being able to bring to you a wire rope made according to this pattern.

Your experience in using "HERCULES" will prove that we are justified in this pride . . . because its performance is proof of its superior quality . . . the result of our determination to make it so.

In order to be suitable for all purposes, "HERCULES" (Red-Strand) is made in a wide range of both Round Strand and Flattened Strand constructions —all of which can be furnished in either the Standard or Preformed type.

"HERCULES" (RED-STRAND) REG. U.S. PAT. OFF. WIRE ROPE

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

WIRE ROPE MAKERS · ESTABLISHED 1857

5909 KENNERLY AVENUE · · ST. LOUIS, MO.

New York.....90 West Street
Chicago.....810 W. Washington Blvd.
Denver.....1554 Wazee Street
San Francisco.....520 Fourth Street
Portland.....914 N. W. 14th Avenue
Seattle.....3410 First Avenue South

New California Crushing Plant

GRANT-PACIFIC ROCK CO. is building a new gravel crushing plant at Lindsay, Calif., said to represent an investment of $75,999. According to W. E. Blanton, manager, the new plant will be located on a 60-acre tract across the road from the old plant. It is expected that it will be ready for use February 1.

Cement Company Buys Dock Facilities in Michigan

MEDUSA PORTLAND CEMENT CO., Cleveland, Ohio, has purchased the Goodrich dock and warehouse on West Eighth street, Holland, Mich., from the Harrington Coal Co. It is reported that the cement company will handle from 25,000 to 50,000 tons of cement annually at the dock and warehouse facilities recently purchased.

Selling Concrete Products

(Continued from page 93)

mote the use of cinder block in connection with other products, such as back-up units to be used with a brick veneer.

By this tie-up, the block manufacturer has enlarged his market, and he also retains the identity of his company in the promotional literature of the supply company. Sales costs are reduced to a minimum, leaving the concrete products manufacturer all his time to devote to the improvement of his product and plant. Shipping and delivery tickets are handled at the plant, but the billing is done by the supply dealer, who also handles credit risks. A telephone switchboard connection keeps the two companies in constant touch with each other. Occasional small pickup orders for products are handled direct at the plant.

Diversify Products to Increase Sales

Manufacturers should diversify their lines of concrete products to include as many special shapes as it is economically possible to produce and stock. In this way a larger percentage of the building expenditure will be obtained and it will also result in more individual sales.

A contractor or architect prefers to deal with as few suppliers as possible as it usually reduces his costs and it simplifies contacts on the job. To this end, it would be very desirable to include concrete joists, window sills, partition blocks, precast lintels, fractional size block, bull-nose block, etc.

Advertising as a sales building force has demonstrated its effectiveness so well in recent years that it would seem that concrete products manufacturers would use it more liberally. Perhaps the reason advertising has not been used more extensively is due to the fact that while its value is appreciated, the average products manufacturer does not know how to advertise. Most manufacturers do not have the knowledge or training to do a good job of advertising and should, if possible, call in an advertising agency or hire someone to direct their advertising.

Central Premix Concrete Co., Spokane, Wash., has found it well worth while to hire a local agency to handle their advertising. This company, which produces concrete products as well as ready-mixed concrete, allots for advertising 4c per cu. yd. of concrete sold. Advertising is run consistently from the latter part of February until June. Weekly advertisements are carried in the Sunday morning paper and the Saturday evening paper on the special building page. This program has been carried through a period of three years. An advertisement is also carried in the classified telephone book. The farm market for concrete products is reached through local agricultural journals. Three thoughts are kept in mind in advertising: (1) Gain the goodwill of architects and builders by boosting the value of their services. (2) Premixed concrete is emphasized as the new and modern way. (3) "Reason why" copy is used—stressing virtues of premix, or ready-mix, but with never any mention of competitive job mix.

It is not necessary to spend a large sum of money for advertising if the present volume of business does not warrant it. Let your advertising grow with your business. Small ads, with a real sales-pulling message, used regularly, will be more effective than a splurge of large space, improperly presented, and then dropped.

NATIONAL GYPSUM CO. has placed an order with Easton Car and Construction Co., for fifteen 6-cu. yd., 36-in. gauge Phoenix cars fitted with Easton-Timken wheels.

STURTEVANT

AIR SEPARATORS

243 STURTEVANTS sold on approval for Cement. Not one rejected.

"HIGH EARLY" and regular cement 1500-3300 S.S. Area.

Engineered Installations for raw or clinker show 25 to 100% capacity increase.

STURTEVANT MILL COMPANY

HARRISON SQUARE

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Fuel Efficiencies in Cement Mills

FUEL CONSUMPTION in the cement plants of the United States had declined from 189 lb. of coal per bbl. of cement in 1914 to 159 lb. in 1935, according to Mineral Trade Notes, U. S. Bureau of Mines, which is significant because of the important factor which fuel is in cement manufacture. In 1914, the cost of fuels and purchased electric energy was 24.7 percent of the total value of cement f.o.b. plant, and in 1935, 19.4 percent.

Principal gains in fuel efficiency in recent years have occurred in wet process plants which show a decline of 18.5 percent between 1927 and 1935. In 1927, wet process plants contributed 34.1 percent of the national output; in 1935, 52.0 percent. In 1927, such plants consumed about 24.4 lb. more of coal or equivalent fuel oil or electric power per bbl. of cement than dry process plants, while in 1935 their fuel consumption had dropped to about 5 lb. below that of dry process plants.

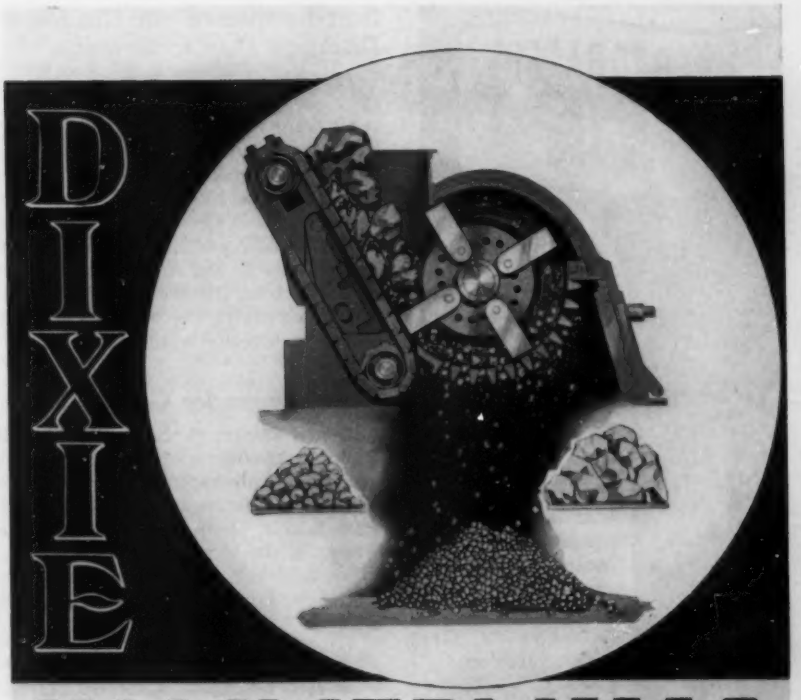
From 1927 to 1935, plants burning oil or natural gas reduced their fuel requirements 21 and 22 percent, respectively, compared with a reduction of only 7 percent in coal-burning plants. Over this period oil burning plants showed the lowest average rate of consumption (118.2 lb. of coal equivalent per bbl. of cement), gas burning plants had the highest rate (143.6 lb.); and coal-burning plants showed 132.3 lb. Before 1919, about 80 percent of the total energy consumption of cement plants was bituminous coal; in 1935 coal contributed 65 percent; natural gas, 20 percent; purchased electricity (used for power, etc.), over 10 percent; and oil, 5 percent.

Quarry Offered to County

THE MEQUON STONE QUARRY, owned by the Milwaukee Electric Railway & Light Co., Milwaukee, Wis., was recently offered for sale to the county board at a meeting at Port Washington, Wis., the price reported being $60,000. The county board will consider the purchase at their February, 1939 meeting.

Approve Plastering Standards

THE AMERICAN STANDARDS ASSOCIATION recently approved as an American Standard new specifications for gypsum plastering and lathing which were sponsored by the American Society for Testing Materials and the American Institute of Architects. Copies of these standards may be obtained by addressing the Gypsum Association, 211 W. Wacker Drive, Chicago.



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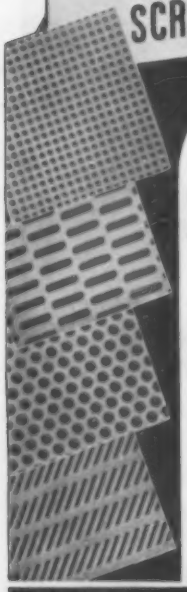

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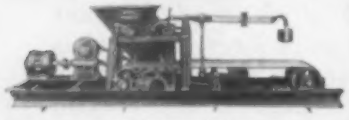

WITH POIDOMETERS

These efficient, accurate, economical weighing and feeding machines have proven their value to operators of cement mills, for accurately proportioning stone and clay —also clinker and gypsum by weight and not by volume.

Also being used for weighing and feeding material to all types of Grinding Mills.

The Poidometer is self-contained. The scale beam is graduated in pounds or kilos, and can be set at whatever amount of material may be required per foot of belt travel; the gate is then adjusted to suit this weight, and the machine will deliver the pre-determined amount of material with an accuracy of ninety-nine per cent.

Write for Catalog No. 2 and get complete profit-producing facts!

Schaffer Poidometer Co.
2828 Smallman St. PITTSBURGH, PA.

Suit Reopened on Claims for Damage Due to Sewage

THE SQUAW ISLAND FREIGHT TERMINAL CO., INC., is again pressing its suit against the city of Buffalo, N. Y., to collect a judgment for $495,623 as alleged damages for pollution of the Niagara river, which had destroyed its sand and gravel deposits. In 1929, the company brought suit for damages. After carrying the case to the Appellate court and retrial, Justice Hinkley ruled in favor of the company. The case is being appealed by the city a second time.

New Owner for Gravel Plant

BINGEN GRAVEL & SAND CO., Bingen, Wash., is the name of the new concern which has leased the John Dann gravel plant near the Hood River-White Salmon bridge. John Cogan of Carson, Wash., is the new owner of the plant, which has been set up to produce commercially various sizes of gravel and sand.

Deliver 45,000th Car of Sand

MILTON J. CARPENTER AND EVERETT N. CARPENTER recently shipped its 45,000th car of sand after 22 years in business in Milwaukee, Wis., serving foundries and allied trades with foundry sands, supplies, and refractories. As a gesture of appreciation to the customer who placed the order for the 45,000th car, the company sent to the Universal Foundry Co., Oshkosh, Wis., a "no charge" invoice covering a car of moulding sand.

Rebuilding Plant

J. A. ECK AND SONS, INC., Montoursville, Penn., is rebuilding its sand and gravel plant, which was destroyed by fire on June 28. The new plant is practically of the same design as the one destroyed, and has a capacity of 90 to 100 tons of washed product per hour. The new structure is of reinforced concrete, brick and steel construction. Much of the equipment is that reclaimed from the fire.

A 300-hp. Fairbanks-Morse Diesel engine will develop the electric power for this plant and the company's nearby silica mill. Last Spring, ready-mixed concrete was added as a sales outlet and batching plants have been established at the gravel plant and at Lock Haven, Penn. A third batching plant is portable for use in nearby locations. Deliveries of concrete are made in two 2½-cu. yd. Blaw-Knox "Trukmixers" and a 1½-cu. yd. Jaeger mixer.

Gravel Firm Buys Trucks

CAMARGO SAND AND GRAVEL CO., Woodward, Okla., has announced the purchase of 10 semi-trailer Ford trucks to be used in hauling gravel to the Fort Supply dam, a distance of 54 miles. The units are equipped with Kingham trailers and Heil 7-ton dump beds.

Vermont Stone Company Expands Operations

VERMONT STONE PRODUCTS CORP., Burlington, Vt., has purchased the Perrotta & Rotella quarry which contains a good quality of red sandstone. According to President Bernard A. Barton, the quarry plant is now set up for a 100-ton-a-day production. Four sizes of stone are now being produced. In the spring, the Vermont Stone Products Corporation may purchase the ready-mixed concrete plant operated by the Barton Construction Co., and center its operations at the quarry.

Limestone Freight Rates

DOLCITO QUARRY CO., Birmingham, Ala., has asked for a reinvestigation into carload intrastates rates on limestone from the Alabama Public Service Commission. The company was recently granted a 10 percent reduction on stone shipped in open cars, but failed to win a cut on that moved in closed cars.

HENRY J. KAISER CO., Oakland, Calif., has requested permission from the Board of Supervisors of Contra Costa County, Calif., to maintain a quarry abutting on Mt. Diablo boulevard.

New sand and gravel plant of J. A. Eck and Son, Inc., Montoursville, Penn., replacing one destroyed by fire

Curing Concrete with Calcium Chloride

THE AMERICAN SOCIETY FOR TESTING MATERIALS has recently adopted as standards certain revisions of specifications for curing concrete with calcium chloride as dry admixture for high early strength and cold weather concreting and as surface treatment for pavement curing.

The new specifications (A. S. T. M. designation C82-38) cover the use of dry flake calcium chloride, as well as the solution form previously prescribed, by simply adding 1 to 2 lb. of calcium chloride per bag of cement used, placed in the skip with the aggregates, before mixing.

Specifications for surface curing of pavements (A. S. T. M. designation C82-38) allow the use of 1½ instead of 2 lb. of calcium chloride per square yard, to be spread over the surface following a minimum of 12 hours of wetted burlap and sprinkling.

Welding Encyclopedia In Ninth Edition

A REVISED EDITION of this book, numbering 696 pages of fine print, has just made its appearance. Developments that have been made since publication of the last edition six years ago are included in the book. A large part of it consequently has been rewritten. At the same time the material has been rearranged into the dictionary style so that reference can be located without consulting an index. As in the past editions, the ninth edition includes a complete list of trade names. Company names are listed alphabetically; in each case all of the trade names used on that company's products being listed.

The book apparently is designed primarily to meet the needs of the practical man using the welding processes. Although it contains considerable engineering data, less emphasis has been placed on the purely technical and research aspects of welding than in the past editions, with the purpose in mind of making the book of maximum value to the practical man in the shop or field. Copies of the book can be obtained directly from the Welding Engineer Publishing Co., 698 South Dearborn St., Chicago, Ill.

TWELVE Milwaukee, Wis., building materials firms have been charged with unlawful restraint of trade and suppression of competition in complaints filed with the Federal Trade Commission. The firms named are: Capitol Building Supply Co.; Wauwatosa Fuel & Supply Co.; Tews Lime & Cement Co.; W. H. Pipkorn Co.; Berthelet Fuel & Supply Co.; Henry Cook Co.; The Froemming Corp.; Schneider Fuel & Supply Co.; Heider & Bott Co.; Otto Ladwig & Sons, Inc.; and J. Druecker Sons' Co.

Court Injunction Against Crushing Plant

AMERICAN NEPHELENE CORP., Rochester, N. Y., has partially shut down its stone crushing plant in compliance with a temporary injunction brought by an adjacent property owner who claimed the dust from the plant killed vegetation. The company has requested that the injunction be lifted as equipment designed to remove dust and noise from its crushing operations is being installed.

Place of Limestone in Synthetic Rubber

THE B. F. GOODRICH CO., Akron, Ohio, is using a considerable tonnage of limestone in the manufacture of koroseal, a synthetic, rubber-like substance. Salt and coke are the other principal ingredients used in making this new product. In certain respects, chemical and otherwise, the material resembles the German synthetic rubber, perbunan.

Marine Development

DOLOMITE MARINE CORP., affiliated with Dolomite Products Co., Inc., Rochester, N. Y., producer of crushed stone, is reported to have approved plans for the first unit of a new marine construction plant for steel barges, etc., at Pittsford, N. Y., to cost about 60,000 with equipment.

Shell Deposits For Lime

SHELL DEPOSITS which have been accumulating in Puget Sound, Washington, may some day be the raw material for a new lime industry, according to Drs. Thos. G. Thompson and Rex J. Robinson of the University of Washington Oceanographic Laboratories. It has been suggested that electric furnaces might be used to make lime, using cheap electricity from some of the big hydro-electric plants now built and building in the Pacific Northwest.

THE GAGER LIME CO., Sherwood, Tenn., placed their first kiln of Azbe design into service in November. They also substituted CO_2 from the kilns for steam from the boiler which heretofore was used in the producer blast.

ILLINOIS MINERALS CO., Murphysboro, Ill., has under consideration a plan to rebuild a portion of the silica mining and processing plant recently destroyed by fire.

BATES SAND & GRAVEL CO., Fairfield, Ohio, reports that they will rebuild their plant at a new location.

LIME PLANT ENGINEERS

KILNS
"ARNOLD" VERTICAL TYPE

HYDRATORS
"WEBER" BATCH.
"SCHAFFER" CONTINUOUS.

COAL FEEDERS
"WARD" ELECTRIC DRIVEN
FOR FIRING VERTICAL KILNS.

SHAKING GRATES
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THE INDUSTRY

New Incorporations

Fairfield County Sand & Gravel Co., Fairfield, Conn., has been incorporated with a capital stock of $10,000 by Ned E. Ostmark, Frank E. Gartland and Esther Wakeman.

McDonald Concrete and Construction Co., Arco, Ga., has been granted a charter with a capital stock of $5,000. Incorporators are M. A. Knight, L. M. McDonald and B. N. Nightingale.

West Texas Sand & Gravel Co., Inc., Big Spring, Tex., has been incorporated with a capital stock of $5,000 by Ida Dee Grafa, Clyde McMahon, and Otis Grafa.

Gaston Stone and Gravel Co., Gastonia, N. C., has been incorporated by H. Lindley Rutter, Glenn Pearson and A. C. Jones with an authorized capital stock of $50,000 and a subscribed stock of $300.

Central Gravel Co., Inc., Chicago, Ill., has been incorporated in Indiana to operate gravel and mineral lands.

Blakley Granite Co., Indianapolis, Ind., has had its charter amended, increasing and changing capital stock to 2,000 shares common, no par value.

Delaware Cement Products Corp., Seaford, Del., has been granted a charter with a capital stock of $50,000. M. H. Harbordt, H. L. Jones and J. L. Willey are incorporators.

Safeway Rock Co. is the name of a new corporation in Tampa, Fla., with a capital stock of 100 shares no par value. Directors are P. E. Dixon, N. J. Falsome and M. E. Dixon.

Martinsville Brick Manufacturing Co., Inc., Martinsville, Va., has been incorporated with a maximum capital of $20,000. D. O. Baldwin is president and Hannibal N. Joyce, attorney.

Belaire Sand & Gravel Co. is the name of a new corporation in Lake Charles, La. Capital stock is $5,000 with 1,000 paid in at the start of business. Rene Belaire, Morris Belaire and David Moore are officers, stockholders and incorporators.

Quality Sand and Gravel Co., Clarksville, Ark., has been incorporated with a capital stock of 100 shares at $100 a share. R. L. Read of Van Buren, Ark., is agent. According to a local report, the firm will operate on the Arkansas river at the mouth of Spadra creek about two miles east of Clarksville.

Soil, Sand and Gravel Corporation of Allegany County, Cumberland, Md., has been granted a charter with a capital stock of 500 shares, $100 par value. Incorporators are Carl A. Low, Ruth Low and Antonette M. Little.

Manufacturers

Blaisdell Equipment and Supply Co., 2143 Barnard St., Cincinnati, Ohio, has succeeded the Blaisdell-Folz Equipment Co. It has the same address as under the former name.

G. S. Rogers & Co., Chicago, has appointed O. M. Gibson, research director. Mr. Gibson was formerly metallurgist of the Dodge Brothers Corp. and was at one time field metallurgical engineer for J. B. Ford Co. He later became manager, metal working research department, E. F. Houghton & Co., Philadelphia. Mr. Gibson is a graduate of the University of Detroit. All production-control and research laboratories of the company's Middle West and Eastern Seaboard plants will be under his supervision.

Iron & Steel Products, Inc., Hegewisch, Ill., has announced that C. W. McKirdy no longer represents it in the Pittsburgh district.

Brooks Equipment & Mfg. Co., Knoxville, Tenn., has appointed Everett Moses as northeastern representative. He was formerly manager of the eastern division of Dempster Bros., Inc. Mr. G. V. Aldridge, formerly in the sales department of the Hug Co., has joined the company to specialize in the sales of the Brooks Load Lugger in the Southwest and on the West Coast.

Timken Roller Bearing Co., Canton, Ohio, has appointed Walter Jehu district manager of its Boston, Mass., office located at 1107 Commonwealth Ave. He was formerly general manager of the Timken Roller Bearing Co., Ltd., Toronto, Canada.

Bay City Shovels, Inc., Bay City, Mich., states that they have shipped more machines during 1938 than in any previous year of their 25 years of building excavating equipment and announce the following new dealer appointments: Henry H. Meyer Co., Inc., 110 S. Howard St., Baltimore, Md., in Maryland, District of Columbia and the four northern counties of Virginia; State Equipment Co., 25 Third St., Parkersburg, W. Va., in West Virginia except Hancock, Brooke, Ohio and Marshal counties; Lon-Lewis Hardware Co., Bessemer, Ala., in central Alabama; and General Supply Co. of Canada, Montreal, Toronto, the addition of province of Quebec to their territory.

Goodyear Tire & Rubber Co., Akron, Ohio, reports that D. R. Burr, consulting manager for the mechanical goods sales department, has retired on pension. A veteran of 44 years of service, he had been associated with Kilborn & Jacobs and Diamond before joining Goodyear in 1913 to take charge of the Chicago office for mechanical goods sales. After holding a number of other positions he was made manager of mechanical goods sales in 1920 and since 1933 has been consulting manager.

Worthington Pump and Machinery Corp., Harrison, N. J., has appointed Walter B. Strong assistant general sales manager. Formerly manager of the corporation's export division, he will continue general supervision of export sales. George Gellhorn, Jr., will succeed Mr. Strong as manager of the export division.

The Osborn Mfg. Co., Cleveland, Ohio, makers of brushes and moulding machines, recently purchased the assets of the Johns Conveyor Corp. of Newark, N. J., and obtained the exclusive patent rights to make and sell this conveyor in the United States and its possessions. This device consists essentially of a rubber tube formed of two separate halves. The material being conveyed is held within the closed halves, which in the form of an endless belt is moved over pulleys. Manufacturing operations are now being moved to Cleveland, and Harry S. Johns, the inventor, will be chief engineer of the Johns Conveyor Division of the Osborn Mfg. Co.

Austin-Western Road Machinery Co., Aurora, Ill., has just completed training 23 men, in an intensive 10-week course, how

Group of men who have completed a ten-week intensive course of training by the Austin-Western Road Machinery Co.

to present the technical features and operating advantages of its products. Those attending the course were selected by Austin-Western distributors in all sections of the country. Most of the men recently completed their college training. The lectures were given by trained instructors, department heads and others under the direction of R. Emmett.

Caterpillar Tractor Co., Peoria, Ill., recently announced that W. O. Bates, Jr., has become the head of the patent department and has been appointed a vice-president of the company. Mr. Bates was formerly located at the San Leandro, Calif., offices of the company.

Hercules Powder Co., Wilmington, Del., announces the appointment of J. Rex St. Clair as manager of the Wilmington office of the explosives department, succeeding J. J. Kelleher, who resigned November 11.

Trade Literature

The following literature, recently published, is available free, upon request to the respective sponsor:

Air Compressors.—Davey Compressor Co., Kent, Ohio. A new 60-page catalog, "The Davey Air Log," in addition to describing the various Davey air compressors, contains more than 100 photographic illustrations as well as line drawings and artists sketches which show these units in operation throughout the world.

Screening.—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1474-B describes its new "Aero-Vibe" inclined type of screens that float in the air suspended by cables and springs, and a new edition of bulletin No. 1478-B describes and illustrates its complete line of single, double and triple deck Low-Head vibrating screens.

Safety Appliances.—Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Penn. Bulletin No. BH-2 describes their Explosives Carrier No. 12 which was developed to provide maximum safety in handling explosives; bulletin No. CT-1 discusses the M. S. A. Midget Impinger, and bulletin No. CT-2, the M. S. A. electrostatic dust and fume sampler, which is designed for quantitative sampling and employs the principle of pre-ionization with electrostatic precipitation.

Compressors.—Ingersoll-Rand Co., Phillipsburg, N. J., has brought out bulletin No. 3072, which illustrates and gives detailed information about the new Ingersoll-Rand heavy-duty Diesel-engine-driven compressor.

Materials Handling Equipment.—Harnischfeger Corp., Milwaukee, Wis. Bulletin X-50 illustrates and gives comprehensive information on the design, special features and operation of P & H Models 1055 and 1055-L6 3-cu. yd. power shovel and dragline, respectively.

Wire Rope.—Broderick & Bascom Rope Co., St. Louis, Mo., has published a new 96-page wire rope catalog which contains data on stresses in suspended cables, stresses in hoist and incline ropes, and specific recommendations as to grades and constructions of rope for various types of power shovels, cranes and other equipment.

Welding Procedures.—The Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, has brought out a profusely illustrated, 36-page bulletin, No. 401-A, which gives procedures for making welds in mild steel, for welding all metals used to any extent industrially and for applying surfacing metal to meet types of wear-action in service.

Tires.—B. F. Goodrich Co., Akron, Ohio, has made available the 1938 edition of its Operators Handbook on heavy duty tires. It includes a table and statistics on the effect of load and speed on tire service and is replete with other useful statistical data in its 66 pages.

Wire Rope.—Macwhyte Co., Kenosha, Wis. Booklet No. 38-100 pictures the application of braided wire rope slings.

Diesel Engines.—Ingersoll-Rand Co., Phillipsburg, N. J., has published a 40-page bulletin on Type "S" diesel engines which contains many illustrations of the engine parts, explaining the relationship of their design to the economical installation and operation characteristics of the unit.

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for SHOVELS DREDGES CRANES CONVEYORS

The Frog, Switch & Mfg. Co.
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Test for Clay Lumps In Concrete Aggregates

A TEST METHOD for determining the amount of lumps in aggregate (C 142-38 T) has been developed by Committee C-9 on Concrete and Concrete Aggregates, A.S.T.M. This is believed to be a necessary complement to the existing specifications covering concrete aggregates (C 33-37 T). Requirements are given for taking the sample and this is then to be spread in a thin layer on the bottom of the container and examined for clay lumps. Any particles which can be broken into finely divided particles with the fingers shall be classified as clay lumps. After all discernible clay lumps have been broken the residue from the clay lumps is to be removed by the use of sieves which are specified. The percentage of clay lumps is then calculated to the nearest 0.1 percent in accordance with a given formula.

Summary of Limestone and Dolomite Uses

ILLINOIS STATE GEOLOGICAL SURVEY has issued Report of Investigations No. 49, "A Summary of the Uses of Limestone and Dolomite," by J. E. Lamar and H. B. Willman. It has been compiled to provide the Illinois stone industry with information to aid in the search for new outlets for their products but is available to producers outside of Illinois as well. Fifty-six different uses of limestone and dolomite are discussed. Such an extensive listing cannot permit more than a brief mention of the various uses, but a bibliography has been included to enable a further investigation of some uses about which more specific information is desired. Also included are tables of limestone production in the United States and in Illinois for 1935.

Portland Cement Statistics

IN NOVEMBER, 1938, the portland cement industry produced 10,184,000 bbl., shipped 8,573,000 bbl. from the mills, and had in stock at the end of the month 22,180,000 bbl., according to the Bureau of Mines. Production and shipments of portland cement in November, 1938, showed increases, respectively, of 10.1 and 4.7 percent, as compared with November, 1937. Portland cement stocks at mills were 2.0 percent lower than a year ago.

Total production for the 11 months ended November 30, 1938, amount to 97,482,000 bbl., compared with 109,431,000 bbl. in the same period of 1937.

Statistics here given are compiled from reports for November received by the Bureau of Mines from all manufacturing plants.

RATIO (PERCENT) OF PRODUCTION TO CAPACITY

	November 1937	1938	Oct. 1938	Sept. 1938	Aug. 1938
The Month	43.7	48.2	52.9	49.9	50.4
12 Months	46.0	40.6	40.2	40.2	40.4

Concrete Pavement Yardage

AWARDS of concrete pavement for November, 1938, have been announced by the Portland Cement Association as follows:

Type of construction	Sq. yds. awarded during Nov. 1938	Total sq. yds. during first eleven months 1938
Roads	2,000,903	34,135,712
Streets	2,496,665	15,997,825
Alleys	85,122	813,002
Total	4,582,690	50,946,539

Sand and Gravel Firm Goes Into Concrete Pipe Business

SOUTHEASTERN SAND AND GRAVEL CO., Tallassee, Ala., has gone into the concrete pipe manufacturing business in Anniston, Ala. The plant building is 40 ft. wide and 110 ft. long, and will represent an investment of about $20,000. Concrete culvert pipe will be the principal product manufactured. Robt. Blount of Tallassee is president of the company; R. E. Ellzey, general manager; G. M. McTeer, sales manager.

Sand-Lime Brick Production and Shipments

NINE active sand-lime brick plants reporting for November and nine for October, statistics for which were published in December.

Average Price for November

	Plant Price	Delivered Price
Detroit, Mich.	.....	$16.00
Grand Rapids, Mich.	11.00	14.00
Milwaukee, Wis.	10.00	12.50
Mishawaka, Ind.	10.50	.....
Saginaw, Mich.	11.00	.....
St. Louis Park, Minn.	8.50	10.00
Syracuse, N. Y.	14.00	16.00 C/L 20.00 L/C

Statistics for October and November

	October†	November‡
Production	2,507,640	2,255,455
Shipment (rail)	629,000	236,000
Shipment (truck)	1,220,605	2,128,502
Stock on hand	1,705,884	1,357,822
Unfilled orders	400,000	180,000

† Nine plants reporting; one reporting shipments 323,950 with no distinction between truck and rail; incomplete, two not reporting stock on hand and three not reporting unfilled orders.

‡ Nine plants reporting; incomplete, three not reporting stock on hand and six not reporting unfilled orders.

BYRNES-CONWAY CO., INC., St. Bernard, Ohio is the new name of what was formerly known as the Superior Ready Mixed Concrete Co., St. Bernard.

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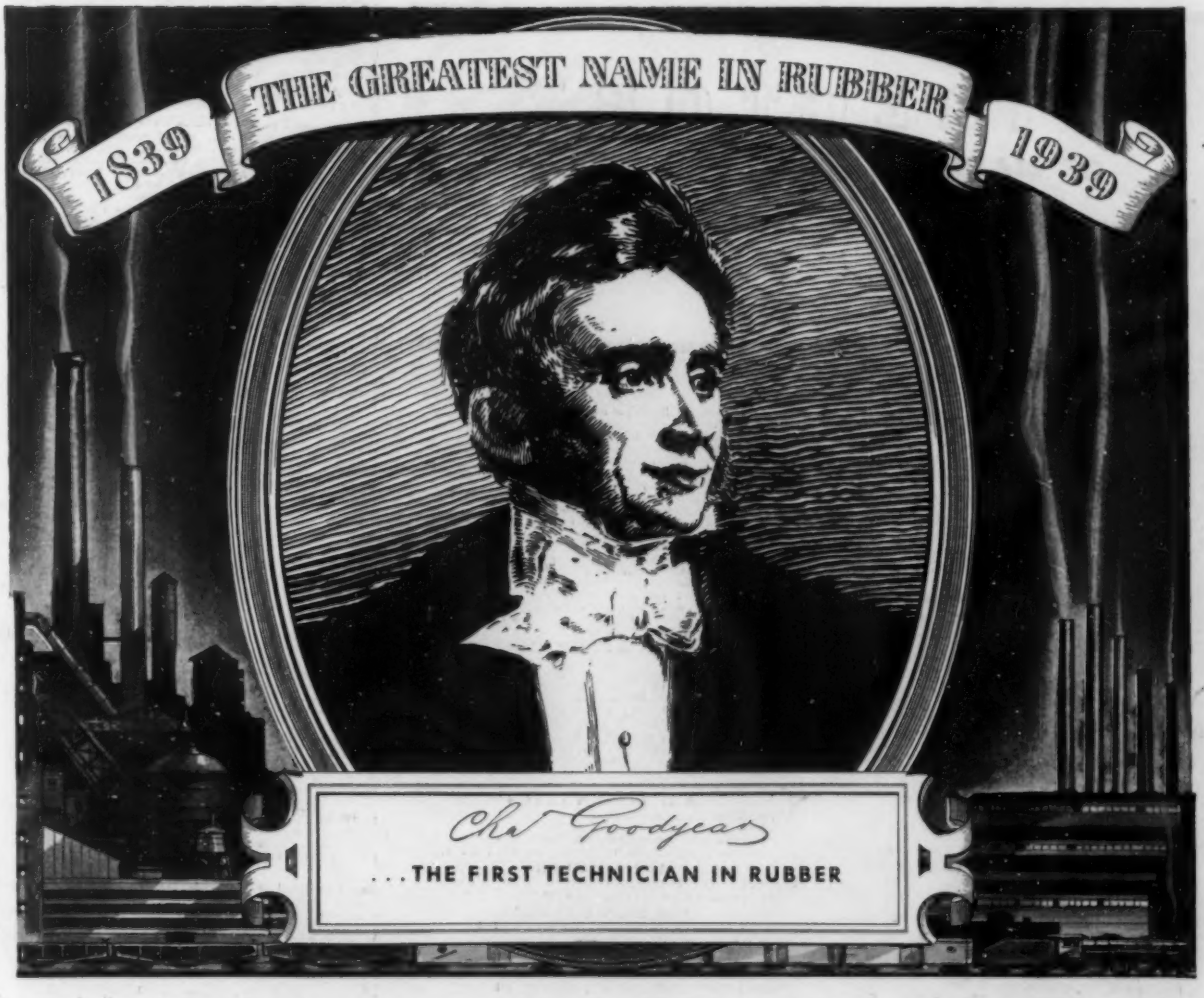
Feeding, proportioning and batching — entirely automatic. The result — finished products of uniform quality with minimum manufacturing costs. The FEEDOWEIGHT correctly and uniformly feeds material by weight. In addition, an automatic totalizer will give you the exact total weight of all material so fed. It is a machine of unexcelled accuracy. Eliminate guesswork in your plant.

Write today for bulletin 388.

MERRICK SCALE MFG. CO. 184 AUTUMN STREET PASSAIC, NEW JERSEY



"Notwithstanding all the difficulties he encountered, he went on. If there was reproach, he bore it. If poverty, he suffered under it. But he went on, and people then saw, when his invention was completed, that what they had been treating with ridicule, was sublime; that what they had made the subject of reproach, was the exercise of great inventive genius; that what they had laughed at, the perseverance of a man of talent with great perceptive faculties, with indomitable perseverance and intellect, had brought out as much to their astonishment, as if another sun had risen in the hemisphere above...

"I believe that the man who sits at this table, Charles Goodyear, is to go down to posterity in the history of the arts in this country, in that great class of inventors, at the head of which stands Robert Fulton... in which class stand the names of Whitney, and of Morris, and in which class will stand 'non post longo intervallo' the humble name of Charles Goodyear."

From the address of DANIEL WEBSTER *before the U. S. Circuit Court, District of New Jersey, in 1852.*

HE DISCOVERED *the process of vulcanization that gave us rubber as we know it today.*

He was first to conceive rubber's wide application in meeting industry's many problems.

He built the first practical rubber belting and demonstrated its efficiency over other kinds.

He fashioned from rubber the first successful hose for handling air, steam, oil, acids and other solvents.

He shaped the first enduring rubber molded goods; contrived from rubber the first dependable packing for steam engines.

In all he either manufactured, patented or envisioned more than one thousand different applications of rubber before his death 79 years ago.

His name was Charles Goodyear. He was the first technician in rubber.

• • •

● This year marks the One Hundredth Anniversary of Charles Goodyear's discovery of vulcanization. In recognition not alone of his great contribution to the world but also of the self-sacrifice, the faith and courage of the man, this tribute is published by an enterprise founded long after his death — a business that, inspired by his example, seeks by serviceability to deserve his name. Dedicated to that service today is the G.T.M.—Goodyear Technical Man—who in countless new industries of which Charles Goodyear never dreamed carries on his work of multiplying rubber's usefulness through specialized application to industrial needs.

THE GOODYEAR TIRE & RUBBER COMPANY
AKRON, OHIO

DIRECTORY

OF MANUFACTURERS' PRODUCTS

Advertisers in this issue are listed in bold face. For information concerning their equipment see their advertising pages. Alphabetical index on page 142. This directory is published as a convenience and not as a part of an advertising contract. While every care has been taken to assure its accuracy we cannot be responsible for errors or omissions.

ABRASIVES
American Foundry Equipt. Co., Mishawaka, Ind.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Pangborn Corp., Hagerstown, Md.
Parsons Engineering Corp., Cleveland, O.
WALL-COLMONOY CORP., Detroit, Mich.

ABRASION RESISTING PLATES
FROG, SWITCH & MFG. CO., Carlisle, Pa.
GILMORE WIRE ROPE DIV., Muncy, Pa.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.

ACETYLENE
Linde Air Products Co., New York, N. Y.
Weldit Acetylene Co., Detroit, Mich.

ADMIXTURES (Aggregate)
Calcium Chloride Assn., Detroit, Mich.
Columbia Alkali Corp., Barberton, O.
Dow Chemical Co., Midland, Mich.
Harshaw Chemical Co., Cleveland, O.
Michigan Alkali Corp., New York, N. Y.
Solvay Sales Corp., New York, N. Y.
Tamms Silica Co., Chicago, Ill.
Victor Chemical Works, Chicago, Ill.

AERIAL TRAMWAYS
AMERICAN CABLE CO., New York, N. Y.
American Steel & Wire Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Broderick & Bascom Rope Co., St. Louis, Mo.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
HAZARD WIRE ROPE CO., Wilkes-Barre, Pa.
Interstate Equipment Corp., Elizabeth, N. J.
LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
MACWHYTE CO., Kenosha, Wis.
ROEBLING'S JOHN A., SONS CO., Trenton, N. J.

AFTERCOOLERS (Air)
Binks Mfg. Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
INGERSOLL RAND CO., New York, N. Y.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Pangborn Corp., Hagerstown, Md.
Sullivan Machinery Co., Michigan City, Ind.
Young Radiator Co., Racine, Wis.

AGGREGATES (Special)
Mica Crystal Co., Warren, N. H.
Universal Marble Products Corp., Thornwood, N. Y.

AGITATORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BLAW-KNOX CO., Pittsburgh, Pa.
Dorr Co., Inc., New York, N. Y.
HARDINGE CO., INC., York, Pa.
HETHERINGTON & BERNER, Inc., Indianapolis, Ind.
MANITOWOC ENGINEERING WORKS, Manitowoc, Wis.
Morris Machine Works, Baldwinsville, N. Y.
Neff & Fry Co., The, Camden, O.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.

AIR CLEANERS
Bayley Blower Co., Milwaukee, Wis.
Pangborn Corp., Hagerstown, Md.

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Binks Mfg. Co., Chicago, Ill.
Buhl Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Continental Motors Corp., Detroit, Mich.
Cooper-Bessemer Corp., Mt. Vernon, O.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Davey Compressor Co., Inc., Kent, O.
De Laval Steam Turbine Co., Trenton, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
FULLER COMPANY, Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
INGERSOLL RAND CO., New York, N. Y.
Le Roi Company, Milwaukee, Wis.
NORDBERG MFG. CO., Milwaukee, Wis.
Pangborn Corp., Hagerstown, Md.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quincy Compressor Co., Quincy, Ill.
Schramm, Inc., West Chester, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
Sterling Machy. Corp., Kansas City, Mo.
Sullivan Machy. Co., Michigan City, Ind.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Worthington Pump & Machy. Corp., Harrison, N. J.

AIR CONDITIONING EQUIPMENT
Bayley Blower Co., Milwaukee, Wis.
Gar Wood Industries, Inc., Detroit, Mich.
Jackson & Church Co., Saginaw, Mich.
Sodeman Heat & Power Co., St. Louis, Mo.

AIR FILTERS
Air-Maze Corp., Cleveland, O.
Alemite Corp., Chicago, Ill.
American Air Filter Co., Inc., Louisville, Ky.
American Blower Corp., Detroit, Mich.
American Foundry Equipt. Co., Mishawaka, Ind.
Binks Mfg. Co., Chicago, Ill.
BLAW-KNOX CO., Pittsburgh, Pa.
Cleveland Rock Drill Co., Cleveland, O.
Connecticut Blower Co., Hartford, Conn.
DRACCO CORP., Cleveland, O.
Federal Pneumatic Systems, Inc., Chicago, Ill.
FULLER COMPANY, Catasauqua, Pa.
Gallagher Co., Salt Lake City, Utah
HARDINGE CO., Inc., York, Pa.
Holly Pneumatic Systems, Inc., New York, N. Y.
INGERSOLL RAND CO., New York, N. Y.
Northern Blower Co., Cleveland, O.
Oliver United Filters, Inc., New York, N. Y.
Pangborn Corp., Hagerstown, Md.
Parsons Eng. Corp., Cleveland, O.
ROEBLING'S, JOHN A., SONS CO., Trenton, N. J.
Schneible Co, Claude B., Chicago, Ill.
Sly, W. W., Mfg. Co., Cleveland, O.
Staynew Filter Corp., Rochester, N. Y.
Western Precipitation Co., Los Angeles, Calif.
Whiting Corp., Harvey, Ill.

AIR HEATERS
American Blower Corp., Detroit, Mich.
American Foundry Equipt. Co., Mishawaka, Ind.
Babcock & Wilcox Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
INGERSOLL RAND CO., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Parsons Engr. Corp., Cleveland, O.
Prat-Daniel Corp., Port Chester, N. Y.
Union Iron Works, Erie, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Young Radiator Co., Racine, Wis.

AIR LINE VALVES
Bailey Meter Co., Cleveland, O.
Cleveland Rock Drill Co., Cleveland, O.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Worthington Pump & Machy. Corp., Harrison, N. J.

AIR NOZZLES
Binks Mfg. Co., Chicago, Ill.
Lunkenheimer Co., The, Cincinnati, O.

AIR SEPARATORS
American Foundry Equipt. Co., Mishawaka, Ind.
Babcock & Wilcox Co., New York, N. Y.
BLAW-KNOX CO., Pittsburgh, Pa.
Bradley Pulveriser Co., Allentown, Pa.
Clark Dust Control Co., Chicago, Ill.
COMBUSTION ENGR. CORP., Chicago, Ill.
Deister Concentrator Co., Fort Wayne, Ind.
Federal Pneumatic Systems, Inc., Chicago, Ill.
GAY, ROBERT M., DIV., Kingston, N. Y.
GRUENDLER CRUSHER & PULVERIZER CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
KENT MILL CO., Brooklyn, N. Y.
Lime & Hydrate Plants Co, York, Pa.
LINK-BELT CO., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Polysius Corp., Bethlehem, Pa.
RAYMOND PULV. DIVISION, Chicago, Ill.
Sly, W. W., Mfg. Co., Cleveland, O.
SMIDTH, F. L. & CO., New York, N. Y.
STURTEVANT MILL CO., Boston, Mass.
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Western Precipitation Co., Los Angeles, Calif.
WILLIAMS PATENT CRUSHER & PULVERIZER CO., St. Louis, Mo.

AIRVEYORS
FULLER COMPANY, Catasauqua, Pa.

ALLOYS (Metal)
American Manganese Steel Co., Chicago Heights, Ill.
Chicago Steel Foundry Co., Chicago, Ill.
FROG, SWITCH & MFG. CO., Carlisle, Pa.
Haynes Stellite Co., Kokomo, Ind.
Manganese Steel Forge Co., Philadelphia, Pa.
Stulz-Sickles Co., Newark, N. J.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
WALL-COLMONOY CORP., Detroit, Mich.

ANTI-FREEZE SOLUTION
Firestone Tire & Rubber Co., Akron, O.

ARRESTORS, LIGHTNING
GENERAL ELECTRIC CO., Schenectady, N. Y.

ASBESTOS CLOTH AND CLOTHING
Keasbey & Mattison Co., San Francisco, Calif.

ASH & REFUSE HANDLING EQUIPMENT
Allen-Sherman-Hoff Co., Philadelphia, Pa.
American Manganese Steel Co., Chicago Heights, Ill.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Easton Car & Construction Co., Easton, Pa.
Fairfield Engr. Co., Marion, O.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.

ASPHALT MIXER REGULATORS
HETHERINGTON & BERNER, INC., Indianapolis, Ind.

ASPHALT MIXING PLANTS
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Construction Machy. Co., Waterloo, Iowa
Easton Car & Construction Co., Easton, Pa.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Iowa Mfg. Co., Cedar Rapids, Iowa
KOEHRING CO., Milwaukee, Wis.
McCarter Iron Works, Inc., Norristown, Pa.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Warren Bros. Roads Co., Boston, Mass.
White Mfg. Co., Elkhart, Ind.

ASPHALT PUMPS
Warren Bros. Roads Co., Boston, Mass.

AXLES
Atlas Car & Mfg. Co., Cleveland, O.
EAGLE IRON WORKS, Des Moines, Iowa
Easton Car & Construction Co., Easton, Pa.

BABBIT METAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carbonite Metal Co., Ltd., Chicago, Ill.
DIXIE MACHY. MFG. CO., St. Louis, Mo.
National Bearing Metals Corp., St. Louis, Mo.
RYERSON, JOS. T., & SONS, INC., Chicago, Ill.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BACKDIGGERS
Bay City Shovels, Inc., Bay City, Mich.
Harnischfeger Corp., Milwaukee, Wis.
Insley Mfg. Corp., Indianapolis, Ind.
LIMA LOCOMOTIVE WORKS, INC. (Shovel & Crane Div.), Lima, O.

BACKFILLERS
Austin-Western Road Machy. Co., Aurora, Ill.
BUCYRUS-ERIE O., South Milwaukee, Wis.
Continental Motors Corp., Detroit, Mich.
Continental Roll & Steel Fdry. Co., East Chicago, Ind.
General Excavator Co., Marion, O.
Harnischfeger Corp., Milwaukee, Wis.
Keystone Driller Co., Beaver Falls, Pa.
LIMA LOCOMOTIVE WORKS, INC. (Shovel & Crane Div.), Lima, O.
LINK-BELT CO., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
NORTHWEST ENGINEERING CO., Chicago, Ill.
Osgood Co., Marion, O.
THEW SHOVEL CO., Lorain, O.

BAGS
Bemis Bros. Bag Co., St. Louis, Mo.
Chase Bag Co., Cleveland, O.
Hammond Bag & Paper Co., Wellsburg, W. Va.
Jaite Company, Jaite, O.
Raymond Bag Co., Middletown, O.

BAG CLEANING MACHINES
LINK-BELT CO., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Stearns Mfg. Co., Adrian, Mich.

BAG TIES
American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

BAGGING MACHINES
Bemis Bros. Bag Co., St. Louis, Mo.
Jaite Company, Jaite, O.
Richardson Scale Co., Clifton, N. J.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.
SYNTRON CO., Homer City, Pa.

BALERS or BUNDLING MACHINES (Sack)
BESSER MFG. CO., Alpena, Mich.
Stearns Mfg. Co., Adrian, Mich.

BALLS (Grinding)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bartlett, C. O., & Sons Co., Cleveland, O.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa. (U. S. Steel Corp. Subsidiary)
Coates Steel Products Co., Greenville, Ill.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Manganese Steel Forge Co., Philadelphia, Pa.
National Malleable & Steel Casting Co., Cleveland, O.
SMIDTH, F. L., & CO., New York, N. Y.
Straub Mfg. Co., Oakland, Calif.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

BAR & ANGLE BENDERS & CUTTERS
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.

BARGES
American Steel Dredge Co., Fort Wayne, Ind.
Chicago Bridge & Iron Co., Chicago, Ill.
EAGLE IRON WORKS, Des Moines, Iowa
MANITOWOC ENGR. WKS., Manitowoc, Wis.

BATCHERS (Weighing and Measuring Volume)
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Bodinson Mfg. Co., San Francisco, Calif.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
FULLER COMPANY, Catasauqua, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
JAEGER MACHINE CO., Columbus, O.
Neff & Fry Co., The, Camden, O.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
SMITH, T. L., CO., Milwaukee, Wis.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BATTERIES
Electric Storage Battery Co., Philadelphia, Pa.
Firestone Tire & Rubber Co., Akron, O.
GOODYEAR TIRE & RUBBER CO., Akron, O.

"WE *Watch* COMPARATIVE MAINTENANCE COSTS...

...*and use* GULF'S *higher quality* LUBRICANTS to keep them down" SAY LEADING EXECUTIVES

"We DISTINGUISH CAREFULLY between LUBRICANTS costs and *LUBRICATION* costs," says this operating executive. "We bring comparative maintenance costs into the picture when we figure our *final* lubrication costs. If maintenance is low while production holds at a steady pace—or increases—we know our *real* lubrication costs are low, even though we've paid a few cents more per gallon for quality lubricants."

That far-sighted viewpoint is helping hundreds of plant men, from Maine to Texas, secure the economies management demands today in manufacturing costs. And it logically leads them to the use of Gulf's higher quality oils and greases. Plant operators find that when these better grades of lubricants are applied as recommended by an experienced Gulf engineer, production flows more smoothly, less time is lost for adjustments and repairs, and maintenance costs are lower. After Gulf quality lubricants have been placed in service, it is not uncommon for plant managers to report savings in maintenances alone amounting to many times the total monthly bill for lubricants!

So we suggest that you *watch comparative maintenance costs* from month to month in your plant, and ask a Gulf engineer to assist you in finding ways to effect savings through improved lubrication. He will work tactfully with your operating men—and they can benefit from his broad experience in the lubrication of machinery similar to yours. Gulf Oil Corporation—Gulf Refining Company, Gulf Building, Pittsburgh, Pennsylvania.

GULF INDUSTRIAL LUBRICATION

Directory of Manufacturers' Products

BATTERY CHARGERS
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BEARING METALS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
National Bearing Metals Corp., St. Louis, Mo.
ROBINS CONVEYING BELT CO., New York, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BEARINGS (Anti-Friction)
Bartlett, C. O., & Snow Co., Cleveland, O.
Bodinson Mfg. Co., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.
EAGLE IRON WORKS, Des Moines, Iowa
Haynes Stellite Co., Kokomo, Ind.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.
Palmer-Bee Co., Detroit, Mich.
ROBINS CONVEYING BELT CO., New York, N. Y.
RYERSON, JOS. T., & SONS, INC., Chicago, Ill.
SKF Industries, Inc., Philadelphia, Pa.
Sprout, Waldron & Co., Muncy, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TIMKEN ROLLER BEARING CO., Canton, O.
Webb City & Carterville Fdry. & Mach. Wks., Webb City, Mo.
Wood's, T. B., Sons Co., Chambersburg, Pa.

BEARINGS (Ball)
Dodge Mfg. Corp., Mishawaka, Ind.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
National Bearing Metals Corp., St. Louis, Mo.
New Departure Div. of General Motors Corp., Bristol, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
SKF Industries, Inc., Philadelphia, Pa.

BEARINGS (Roller)
Detroit Belt Lacer Co., Detroit, Mich.
Dodge Mfg. Corp., Mishawaka, Ind.
Flexible Steel Lacing Co., Chicago, Ill.
Hyatt Roller Bearing Co., Newark, N. J.
LINK-BELT CO., Chicago, Ill.
Messinger Bearings, Inc., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
ROBINS CONVEYING BELT CO., New York, N. Y.
SKF Industries, Inc., Philadelphia, Pa.
Sprout, Waldron & Co., Muncy, Pa.
Tuloch, W. O. & M. W., Inc., Providence, R. I.
TIMKEN ROLLER BEARING CO., Canton, O.
Victor Balata & Textile Belting Co., New York, N. Y.

BEARINGS (Tapered Roller)
LINK-BELT CO., Chicago, Ill.
TIMKEN ROLLER BEARING CO., Canton, O.

BEARINGS (Thrust)
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Palmer-Bee Co., Detroit, Mich.
SKF Industries, Inc., Philadelphia, Pa.
TIMKEN ROLLER BEARING CO., Canton, O.

BELT IDLERS
American Manganese Steel Co., Chicago Heights, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Jeffrey Mfg. Co., The, Columbus, O.
LINK-BELT CO., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMITH ENGR. WORKS, Milwaukee, Wis.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BELT LACING
ARMSTRONG-BRAY & CO., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Crescent Belt Fastener Co., New York, N. Y.
Detroit Belt Lacer Co., Detroit, Mich.
Flexible Steel Lacing Co., Chicago, Ill.
Rhoads, J. E., & Son, Philadelphia, Pa.

BELT LACING MACHINES
ARMSTRONG-BRAY & CO., Chicago, Ill.
Detroit Belt Lacer Co., Detroit, Mich.

BELT SCRAPERS
Stephens-Adamson Mfg. Co., Aurora, Ill.

BELT CUTTING MACHINES
Detroit Belt Lacer Co., Detroit, Mich.
Flexible Steel Lacing Co., Chicago, Ill.

BELT FASTENERS OR HOOKS
ARMSTRONG-BRAY & CO., Chicago, Ill.
Crescent Belt Fastener Co., New York, N. Y.

BELT TIGHTENERS
Dodge Mfg. Corp., Mishawaka, Ind.
LINK-BELT CO., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Wood's, T. B., Sons Co., Chambersburg, Pa.

BELT TRIPPERS
Bartlett, C. O., & Snow Co., Cleveland, O.
BACON, EARLE C., INC., New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
Diamond Iron Works, Minneapolis, Minn.
Fairfield Engr. Co., Marion, O.
Interstate Equipt. Corp., Elizabeth, N. J.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Co., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Portable Machinery Co., York, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BELTING (Asbestos)
Victor Balata & Textile Belting Co., New York, N .Y.

BELTING (Chain)
Chain Belt Co., Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BELTING (Conveyor and Elevator)
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Boston Woven Hose & Rubber Co., Boston, Mass.
Chain Belt Co., Milwaukee, Wis.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Fairfield Engr. Co., Marion, O.
Manson Glover, Stoughton, Mass.
Goodall Rubber Co., Philadelphia, Pa.
Goodrich, B. F., Co., Akron, O.
Good Roads Machinery Corp., Kennett Square, Pa.
GOODYEAR TIRE & RUBBER CO., INC., Akron, O.
Haiss, Geo., Mfg. Co., New York, N. Y.
Hewitt Rubber Corp., Buffalo, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Manhattan Rubber Mfg. Co., Passaic, N. J.
New York Belting & Packing Co., New York, N. Y.
Portable Machinery Co., York, Pa.
Quaker City Rubber Co., Philadelphia, Pa.
Republic Rubber Co., Youngstown, O.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.

BELTING (Metal)
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

BELTING (Transmission)
BACON, EARLE C., INC., New York, N. Y.
Boston Woven Hose & Rubber Co., Boston, Mass.
Central Rubber & Sup. Co., Indianapolis, Ind.
Chain Belt Co., Milwaukee, Wis.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Gilmer, L. H., Co., Philadelphia, Pa.
Goodall Rubber Co., Philadelphia, Pa.
Goodrich, B. F., Co., Akron, O.
GOOODYEAR TIRE & RUBBER CO., INC., Akron, O.
Haiss, Geo., Mfg. Co., New York, N. Y.
Hewitt Rubber Corp., Buffalo, N. Y.
Imperial Belting Co., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Manhattan Rubber Mfg. Co., Passaic, N. J.
New York Belting & Packing Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
Republic & Sup. Co., Indianapolis, Ind.
Rhoads, J. E., & Son, Philadelphia, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BELTING (V-Type)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Gates Rubber Co., Denver, Colo.
Gilmer, L. H., Co., Philadelphia, Pa.
Goodrich, B. F., Co., Akron, O.
GOODYEAR TIRE & RUBBER CO., INC., Akron, O.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber Co., Trenton, N. J.
Wood's, T. B., Sons Co., Chambersburg, Pa.

BELTING (Wire)
Bristol Co., Waterbury, Conn.
Stephens-Adamson Mfg. Co., Aurora, Ill.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

BIN GATES
Allen-Sherman-Hoff Co., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., Cleveland, O.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O. & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Chicago Bridge & Iron Works, Chicago, Ill.
Diamond Iron Works, Minneapolis, Minn.
EAGLE IRON WORKS, Des Moines, Iowa
Erie Steel Construction Co., Erie, Pa.
Fairfield Engr. Co., Marion, O.
FULLER COMPANY, Catasauqua, Pa.
GAY, RUBERT M. DIV, Kingston, N. Y.
General Conveyor & Mfg. Co., St. Louis, Mo.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., Inc., New York, N. Y.
HARDINGE CO., INC., York, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
HENDRICK MFG. CO., Carbondale, Pa.
Industrial Brownhoist Corp., Cleveland, O.
Insley Mfg. Corp., Indianapolis, Ind.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jackson & Church Co., Saginaw, Mich.
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Manganese Steel Forge Co., Philadelphia, Pa.
Neff & Fry Co., The, Camden, O.
Northern Blower Co., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Works, Inc., Minneapolis, Minn.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
SMITH ENGR. WORKS, Milwaukee, Wis.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stedman's Fdy. & Mach. Works, Aurora, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Toepfer & Sons Co., W. Milwaukee, Wis.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Webster Mfg. Co, Tiffin, O.

BIN INDICATORS
Bin-Dicator Co., Detroit, Mich.
FULLER COMPANY, Catasauqua, Pa.

BIN VALVES
Stephens-Adamson Mfg. Co., Aurora, Ill.

BINS (Storage)
Allen-Sherman-Hoff Co., Philadelphia, Pa.
Atlas Car & Mfg. Co., Cleveland, O.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bartlett, C. O. & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Burrell Eng. & Const. Co., Chicago, Ill
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Chicago Bridge & Iron Co., Chicago, Ill., (Hopper and Steel Storage)
Diamond Iron Works, Inc., Minneapolis, Minn.
EAGLE IRON WORKS, Des Moines, Iowa
Erie Steel Constr. Co., Erie, Pa.
GAY, RUBERT M. DIV., Kingston, N. Y.
Good Roads Machy. Corp., Kennett Square, Pa.
HARDINGE CO., INC., York, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
HENDRICK MFG. CO., Carbondale, Pa.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Insley Mfg. Co., Indianapolis, Ind.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., Columbus, O.
Johnson, C. S., Co., Champaign, Ill.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Long, M. A., Co., Baltimore, Md.
MacDonald Engineering Co., Chicago, Ill.
Manganese Steel Forge Co., Philadelphia, Pa.
Marietta Concrete Corp., Marietta, O.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Neff & Fry Co., The, Camden, O.
Northern Blower Co., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engineering Works, Inc., Minneapolis, Minn.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. J. (Concrete)
Richardson Scale Co., Clifton, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Webster Mfg. Co., Tiffin, O.

BLAST CLEANING EQUIPMENT
Pangborn Corp., Hagerstown, Md.

BLASTING CAPS
Atlas Powder Co., Wilmington, Del. (Electric)
Burton Explosives, Inc., New York, N. Y.
DU PONT, E. I., de NEMOURS & CO., INC., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.

BLASTING CAP CRIMPERS
ENSIGN-BICKFORD CO., Simsbury, Conn.

BLASTING CAP PROTECTORS
Goodrich, B. F., Akron, O.

BLASTING MACHINES
Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., New York, N. Y.
DU PONT, E. I., de NEMOURS & CO., INC., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.

BLASTING SUPPLIES
Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., New York, N. Y.
DU PONT, E. I., de NEMOURS & CO., INC., Wilmington, Del.
ENSIGN-BICKFORD CO., Simsbury, Conn.
Hercules Powder Co., Wilmington, Del.
National Powder Co., Eldred, Pa.
Illinois Powder Mfg. Co., St. Louis, Mo.
Independent Explosives Co., Cleveland, O.

BLASTING TUBING
Goodrich, B. F., Co., Akron, O.
Manhattan Rubber Mfg. Co., Passaic, N. J.

BLOCK MACHINES, BUILDING (Concrete)
ANCHOR CONCRETE MACHY. CO., Columbus, O.
BESSER MFG. CO., Alpena, Mich.
Blystone Mfg Co., Cambridge Springs, Pa.
Dunn, W. E., Mfg. Co., Holland, Mich.
Essick Machy. Co., Los Angeles, Calif.
Foote, J. B., Fdry. Co., Fredericktown, O.
Hollostone Co., No. Hollywood, Calif.
KENT MACH. CO., Cuyahoga Falls, O.
Miles Mfg. Co., Jackson, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
R & L Concrete Machy. Co., Kendallville, Ind.
Sill & Rawlings Concrete Block Co., Tonganoxie, Kan.
Stearns Mfg. Co., Adrian, Mich.

BLOCK RACKS
KENT MACHINE CO., Cuyahoga Falls, O.

BLOCKS (Pillow)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Co., New York, N. Y.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Messenger Bearings, Inc., Philadelphia, Pa.
Oliver Machy. Co., Grand Rapids, Mich.
Palmer-Bee Co., Detroit, Mich.
ROBINS CONVEYING BELT CO., New York, N. Y.
SKF Industries, Inc., Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TIMKEN ROLLER BEARING CO., Canton, O.

BLOCKS (Sheave)
American Hoist & Derrick Co., St. Paul, Minn.
American Manganese Steel Co., Chicago Heights, Ill.
Clyde Iron Works, Inc., Duluth, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
Haiss, Geo., Mfg. Co., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Pioneer Engr. Works, Inc., Minneapolis, Minn.
Roebling's, John A., Sons Co., Trenton, N. J.
SAUERMAN BROS., INC., Chicago, Ill.
Sprout, Waldron & Co., Muncy, Pa.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bayley Blower Co., Milwaukee, Wis.
Connecticut Blower Co., Hartford, Conn.

ROCK PRODUCTS STANDARDS OF PRACTICE

The publishers of ROCK PRODUCTS have always dedicated their best efforts to the cause of business and social service and to this end have pledged themselves:

1. To consider, first, the interests of the subscriber.

2. To subscribe to and work for truth and honesty in all departments.

3. To eliminate, insofar as possible, their personal opinions from their news columns, but to be a leader of thought in their editorial columns, and to make their criticisms constructive.

4. To refuse to publish "puffs", free reading notices or paid "write-ups"; to keep their reading columns independent of advertising considerations, and to measure all news by this standard: "Is it real news?"

5. To decline any advertisement which has a tendency to mislead or which does not conform to business integrity.

6. To solicit subscriptions and advertising solely upon the merits of the publication.

7. To supply advertisers with full information regarding character and extent of circulation, including detailed circulation statements, subject to proper and authentic verification.

8. To cooperate with all organizations and individuals engaged in creative advertising work.

9. To avoid unfair competition.

10. To determine what is the highest function of the field which they serve and then to strive in every legitimate way to promote that function.

This code of The ASSOCIATED BUSINESS PAPERS, INC., an organization of business paper publishers which was formed more than twenty years ago, was adopted to set standards of publishing pointing the path to stable progress for the long pull. ROCK PRODUCTS is the only paper in this field which is a member of A.B.P.

The constant maintenance of these standards has made ROCK PRODUCTS the outstanding industrial journal serving this field and has attracted to it a host of life-long friends in its advertisers and readers.

ROCK PRODUCTS 205 WEST WACKER DRIVE CHICAGO, ILLINOIS

Directory of Manufacturers' Products

De Laval Steam Turbine Co., Trenton, N. J.
Diamond Iron Works, Minneapolis, Minn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Jeffrey Mfg. Co., Columbus, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Sly, W. W., Mfg. Co., Cleveland, O.

BLUE PRINTING MACHINERY

Pease Co., The C. F., Chicago, Ill.

BOATS

Chicago Bridge & Iron Co., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.

BOATS (Self-Unloading)

LINK-BELT CO., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
Smith, Leatham D., Dock Co., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BOILER ACCESSORIES

Johnson Corp., Three Rivers, Mich.
Lunkenheimer Co., Cincinnati, O.
Union Iron Works, Erie, Pa.

BOILERS

American Hoist & Derrick Co., St. Paul, Minn.
Babcock & Wilcox Co., New York, N. Y.
COMBUSTION ENGINEERING CO., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Orr & Sembower, Inc., Reading, Pa.
Union Iron Works, Erie, Pa.

BOLTS

Standard Pressed Steel Co., Jenkintown, Pa.

BOND WIRE

American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)

BONDING COMPOUNDS

Harbison-Walker Refractories Co., Pittsburgh, Pa.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Ranetite Mfg. Co., Inc., St. Louis, Mo.

BOOTS AND SHOES

Goodrich, B. F., Co. Akron, O.

BRAKE LINING

Firestone Tire & Rubber Co., Akron, O.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Palmer Asbestos & Rubber Corp., Chicago, Ill.
Wagner Electric Corp., St. Louis, Mo.

BRICK MACHINES AND MOLDS

BESSER MFG. CO., Alpena, Mich.
Deister Concentrator Co., Ft. Wayne, Ind.
Dunn, W. E., Mfg. Co., Holland, Mich
Jackson & Church Co., Saginaw, Mich.
Miles Mfg. Co., Jackson, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
R & L Concrete Machy. Co., Kendallville, Ind.
Stearns Mfg. Co., Adrian, Mich.

BUCKETS (Clamshell, Crab and Orange Peel)

Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Diamond Iron Works, Inc., Minneapolis, Minn.
Erie Steel Constr. Co., Erie, Pa.
General Excavator Co., The, Marion, O.
Haiss, Geo., Mfg. Co., Inc., New York, N. Y.
Hanson Excavator Works, Div. of The Hanson Clutch & Machy. Co., Tiffin, O.
Harnischfeger Corp., Milwaukee, Wis.
HAYWARD CO., New York, N. Y.
Industrial Brownhoist Corp., Cleveland, O.
JAEGER MACHINE CO., Columbus, O.
Kiesler Co., Jos. F., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Osgood Co., Marion, O.
Owen Bucket Co., Cleveland, O.
Pettibone Mulliken Corp., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Wellman Engr. Co. (G. H. Williams), Cleveland, O.

BUCKETS (Conveyor and Elevator)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
BROOKS EQUIPT. & MFG. CO., Knoxville, Tenn.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Chicago Steel Fdry. Co., Chicago, Ill.
Construction Machy. Co., Waterloo, Iowa
Diamond Iron Works, Inc., Minneapolis, Minn.
EAGLE IRON WORKS, Des Moines, Iowa
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Huron Industries, Inc., Alpena, Mich.
Industrial Brownhoist Corp., Cleveland, O.
Iowa Mfg. Co., Cedar Rapids, Iowa
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Lewistown Fdry. & Machine Co., Lewistown, Pa.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Manganese Steel Forge Co., Philadelphia, Pa.
Palmer-Bee Co., Detroit, Mich.
Parsons Engr. Corp., Cleveland, O.
Pettibone Mulliken Corp., Chicago, Ill.
Pioneer Engr. Works, Minneapolis, Minn.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMITH, F. L., & CO., New York, N. Y.
SMITH ENGR. WORKS, Milwaukee, Wis.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stedman's Fdry. & Machine Co., Aurora, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Toepfer, W., & Sons Co., Milwaukee, Wis.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
Webb City and Carterville Fdy. & Mach. Works, Webb City, Mo.

BUCKETS (Dragline and Slackline)

American Manganese Steel Co., Chicago Heights, Ill.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bay City Shovels, Inc., Bay City, Mich.
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Diamond Iron Works, Inc., Minneapolis, Minn.
Erie Steel Constr. Co., Erie, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Hanson Excavator Works Div. of The Hanson Clutch & Machy. Co., Tiffin, O.
Harnischfeger Corp., Milwaukee, Wis.
HAYWARD CO., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Interstate Equipt. Corp., Elizabeth, N. J.
Iowa Mfg. Co., Cedar Rapids, Iowa
LINK-BELT CO., Chicago, Ill.
Owen Bucket Co., Cleveland, O.
Page Engr. Co., Chicago, Ill.
Pioneer Engr. Works, Minneapolis, Minn.
SAUERMAN BROS., INC., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Wellman Engr. Co. (G. H. Williams), Cleveland, O.

BUCKETS (Dredge and Excavator)

BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Haiss, Geo., Mfg. Co., Inc., New York, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
HAYWARD CO., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Owen Bucket Co., Cleveland, O.
Wellman Engr. Co. (G. H. Williams), Cleveland, O.

BUCKETS (Dump)

BROOKS EQUIPT. & MFG. CO., INC., Knoxville, Tenn.
DEMPSTER BROS. INC., Knoxville, Tenn.
JAEGER MACHINE CO., Columbus, Ohio

BUCKETS (Electric Heated, Weighing)

Easton Car & Constr. Co., Easton, Pa.

BUCKETS (Tramway)

American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
Interstate Equipt. Corp., Elizabeth, N. J.

BUILDING TILE MACHINES

BESSER MFG. CO., Alpena, Mich.
Flam, Stephen, Sherman Oaks, Calif.
Miles Mfg. Co., Jackson, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
R & L Concrete Machy. Co., Kendallville, Ind.
Stearns Mfg. Co., Adrian, Mich.

BULK CEMENT BATCHING PLANTS

Heltzel Steel Form & Iron Co., Warren, O.
Sprout, Waldron & Co., Muncy, Pa.

BULK CEMENT STORAGE PLANTS

BLAW-KNOX CO., Pittsburgh, Pa.
Butler Bin Co., Waukesha, Wis.
Chicago Bridge & Iron Co., Chicago, Ill.
Heltzel Steel Form & Iron Co., Warren, O.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

BULLDOZERS

Baker Mfg. Co., The, Springfield, Ill.
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Gar Wood Industries, Inc., Detroit, Mich.
KOEHRING CO., Milwaukee, Wis.
Le Tourneau, R. G., Inc., Peoria, Ill.

BULLSCRAPERS

BUCYRUS-ERIE CO., S. Milwaukee, Wis.

BURIAL VAULT FORMS AND MOLDS (Concrete)

American Vault Works, Inc., Forest Park, Ill.
Artisan Mold Works, Elkhart, Ind.
Ashland Vault Co., Ashland, O.
Automatic Sealing Vault Co., Peru, Ind.
Doswell & Kover, Ft. Wayne, Ind.
Haase, Wilbert W., Co., Inc., Forest Park, Ill.
Mead-Suydam Co., Orange, N. J.
Norwalk Vault Co., Norwalk, O.
Sterling Concrete Vault Co., Chicago, Ill.

BUSHINGS

EAGLE IRON WORKS, Des Moines, Iowa
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Manganese Steel Forge Co. Inc., Philadelphia, Pa.
National Bearing Metals Corp., St. Louis, Mo.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wood's, T. B., Sons Co., Chambersburg, Pa.

CABLEWAYS

AMERICAN CABLE CO., New York, N. Y.
American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
BLAW-KNOX CO., Pittsburgh, Pa.
Broderick & Bascom Rope Co., St. Louis, Mo.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
BLAUPORE WIRE ROPE DIV., Muncy, Pa.
HAZARD WIRE ROPE CO., Wilkes-Barre, Pa.
Interstate Equipt. Corp., Elizabeth, N. J.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
LINK-BELT CO., Chicago, Ill.
MACWHYTE CO., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
SAUERMAN BROS., INC., Chicago, Ill.
Wellman Engineering Co, Cleveland, O.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

CABLES (Electric)

GENERAL ELECTRIC CO., Schenectady, N. Y.
Okonite Co., The, Passaic, N. J.

CALCINING EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., Cleveland, O.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Bradley Pulverizer Co., Allentown, Pa.
Christie Co., L. R., Pittsburgh, Pa.
Ehrsam, J. B., & Son Mfg. Co., Enterprise, Kan.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

CALCIUM CHLORIDE

Calcium Chloride Assn., Detroit, Mich.
Columbia Alkali Corp., Barberton, O.
Dow Chemical Co., Midland, Mich.
DU PONT, E. I., de NEMOURS & CO., Wilmington, Del.
Harshaw Chemical Co., Cleveland, O.
Michigan Alkali Corp., New York, N. Y.
Solvay Sales Corp., New York, N. Y.

CAPACITATORS

GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

CAPSTANS

Dake Engine Co., Grand Haven, Mich.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.

CARBIDE

Linde Air Products Co., New York, N. Y.

CAR COUPLINGS AND HITCHES

Atlas Car & Mfg. Co., Cleveland, O.
Easton Car & Constr. Co., Easton, Pa.
MACWHYTE CO., Kenosha, Wis.
National Malleable & Steel Casting Co., Cleveland, O.

CAR DOORS, FIBRE (Leak Proof)

Hummel-Foley Corp., Hopewell, Va.

CAR DUMPERS

Atlas Car & Mfg. Co., Cleveland, O.
EAGLE IRON WORKS, Des Moines, Iowa
Easton Car & Constr. Co., Easton, Pa.
LINK-BELT CO., Chicago, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Wellman Engr. Co., Cleveland, O.

CAR LINERS

Atlas Car & Mfg. Co., Cleveland, O.
Hummell-Foley Corp., Hopewell, Va.
Jaite Co., Jaite, O.

CAR PULLERS AND MOVERS

American Hoist & Derrick Co., St. Paul, Minn.
Appleton-Atlas Car Mover Corp., Milwaukee, Wis.
Atlas Car & Mfg. Co., Cleveland, O.
Bartlett, C. O., & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Clyde Iron Works, Duluth, Minn.
Dake Engine Co., Grand Haven, Mich.
Diamond Iron Works, Minneapolis, Minn.
Edelblute Mfg. Co., Reynoldsville, Pa.
Foote Bros. Gear & Mach. Corp., Chicago, Ill.
GILMORE WIRE ROPE DIV., Muncy, Pa.
Godfrey Conveyor Co., Elkhart, Ind.
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., Columbus, O.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.
LINK-BELT CO., Chicago, Ill.
Ottumwa Iron Works, Ottumwa, Iowa
ROBINS CONVEYING BELT CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CARS (Industrial, Quarry, Dump, Concrete, Block, Etc.)

Atlas Car & Mfg. Co., Cleveland, O.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
Bethlehem Steel Co. Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa. (U. S. Steel Corp. Subsidiary)
Chase Foundry & Mfg. Co., Columbus, O.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
EAGLE IRON WORKS, Des Moines, Iowa
Easton Car & Constr. Co., Easton, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Koppel Industrial Car & Equipt. Co., Pittsburgh, Pa
LINK-BELT CO., Chicago, Ill.
Miles Mfg. Co., Jackson, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
National Malleable & Steel Casting Co., Cleveland, O.
Ottumwa Iron Works, Ottumwa, Iowa
Pressed Steel Car Co., Pittsburgh, Pa.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
Richardson Scale Co., Clifton, N. J.
Riddell, W. A., Corp., Bucyrus, O.
Sanford-Day Iron Works, Knoxville, Tenn
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Watt Car & Wheel Co., Barnesville, O.
Whiting Corp., Harvey, Ill.

CAR REPLACERS

Edelblute Mfg. Co., Reynoldsville, Pa.

CARS TO RENT

ROBINSON AUTO RENTAL CO., Philadelphia, Pa.

CAR WHEELS

American Manganese Steel Co., Chicago Heights, Ill.
Atlas Car & Mfg. Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Foundry & Mfg. Co., Columbus, O.
EAGLE IRON WORKS, Des Moines, Iowa
Easton Car & Constr. Co., Easton, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Iowa Mfg. Co., Cedar Rapids, Iowa
LINK-BELT CO., Chicago, Ill.
National Malleable & Steel Castings Co., Cleveland, O.
Oliver Machy. Co., Grand Rapids, Mich.
Ottumwa Iron Works, Ottumwa, Iowa
Pettibone Mulliken Corp., Chicago, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Watt Car & Wheel Co., Barnesville, O.

You are cordially invited to attend

The

Twenty-third Annual Convention and Exposition
NATIONAL SAND AND GRAVEL ASSOCIATION

☆

Ninth Annual Convention and Exposition
NATIONAL READY MIXED CONCRETE ASSOCIATION

Netherland Plaza Hotel
Cincinnati, Ohio

January 25, 26 and 27, 1939

The program will be a practical one devoted to the practical problems of the two industries. All who are interested in sand and gravel and ready mixed concrete are cordially invited to be present.

☆

NATIONAL SAND AND GRAVEL ASSOCIATION
NATIONAL READY MIXED CONCRETE ASSOCIATION

Munsey Building ● Washington, D. C.

Directory of Manufacturers' Products

CAR WRENCHES
Appleton-Atlas Car Mover Corp., Milwaukee, Wis.

CARS (Remote Control)
Atlas Car & Mfg. Co., Cleveland, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

CARTS (Concrete)
BLAW-KNOX CO., Pittsburgh, Pa.
Construction Machy. Co., Waterloo, Iowa
Haiss, Geo., Mfg. Co., New York, N. Y.
JAEGER MACHINE CO., Columbus, O.
LINK-BELT CO., Chicago, Ill.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
Toledo Wheelbarrow Co., The, Toledo, O.

CASTINGS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alloy Cast Steel Co., Marion, O.
American Manganese Steel Co., Chicago Heights, Ill.
Babcock & Wilcox Co., New York, N. Y.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
BLAW-KNOX CO., Pittsburgh, Pa.
Buchanan, C. G., Co., Inc., New York, N. Y
Cement Mill Equipt Co., Plymouth, Mich.
Chain Belt Co., Milwaukee, Wis.
Chicago Steel Foundry Co., Chicago, Ill.
Clyde Iron Works, Inc., Duluth, Minn.
Commercial Steel Co., Marion, O.
Continental Motors Corp., Detroit, Mich.
Dake Engine Co., Grand Haven, Mich.
Diamond Iron Works, Inc., Minneapolis, Minn.
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
EAGLE IRON WORKS, Des Moines, Iowa
Falk Corp., Milwaukee, Wis.
FROG, SWITCH & MFG. CO., Carlisle, Pa.
HARDINGE CO., INC., York, Pa.
Haynes Stellite Co., Kokomo, Ind.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Holmes, Robt., & Bros., Inc., Danville, Ill.
Huron Industries, Inc., Alpena, Mich.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
KENSINGTON STEEL CO., Chicago, Ill.
La-Del Conveyor & Mfg Co., New Philadelphia, O.
LIMA LOCOMOTIVE WORKS, INC. (Shovel & Crane Div.), Lima, O.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
National Bearing Metals Corp., St. Louis, Mo.
National Malleable & Steel Casting Co., Cleveland, O.
Oliver Machy. Co., Grand Rapids, Mich.
Pettibone-Mulliken Corp., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
Ross-Meehan Foundries, Chattanooga, Tenn.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stedman's Foundry & Mach. Works, Aurora, Ind.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
TIMKEN ROLLER BEARING CO., Canton, O.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
WALL-COLMONOY CORP., Detroit, Mich.

CEMENT
Dewey Portland Cement Co., Kansas City, Mo.
HARDINGE CO., INC., York, Pa.

CEMENT, ALUMNITE
Jaite Co., Jaite, O.

CEMENT COLORS
Harshaw Chemical Co., The, Cleveland, O.
MEPHAM, GEO. S., CORP., East St. Louis, Ill.
Ranetite Mfg. Co., Inc., St. Louis, Mo.
Reardon Cement Co., Cincinnati, O.
RICKETSON MINERAL COLOR WORKS, Milwaukee, Wis.
Tamms Silica Co. Chicago, Ill.

CEMENT PLANTS (Contractors)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Erie Steel Constr. Co., Erie, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Neff & Fry Co., The, Camden, O.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

CEMENT PROCESS
Cement Process Corp., Mexico City, Mexico

CEMENT PUMPS
FULLER CO., Catasauqua, Pa.
SMIDTH, F. L., & CO., New York, N. Y.

CEMENT SPRAY GUN
Eureka Art Stone Works, Eureka, Calif.
Colorcrete Industries, Holland, Mich.

CENTRAL MIXING PLANTS (Concrete)
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Erie Steel Construction Co., Erie, Pa.
Heltzel Steel & Iron Co., Warren, O.
JAEGER MACHINE CO., Columbus, O.
Neff & Fry Co., The, Camden, O.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CHAIN (Conveyor and Elevator)
American Manganese Steel Co., Chicago Heights, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O
Bodinson Mfg. Co., Inc., San Francisco, Calif.
BROOKS EQUIPT. & MFG. CO., Knoxville, Tenn.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Manganese Steel Forge Co., Philadelphia, Pa.
Neff & Fry Co., The, Camden, O.
Palmer-Bee Co., Detroit, Mich.
Pettibone Mulliken Corp., Chicago, Ill.
Portable Machy. Corp., York, Pa.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Union Chain & Mfg. Co., The, Sandusky, O.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHAIN (Dredge and Shovel)
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Haiss, Geo., Mfg. Co., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
KENSINGTON STEEL CO., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
National Malleable & Steel Casting Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.
Pettibone Mulliken Corp., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Whitney Chain & Mfg. Co., Hartford, Conn.

CHANNELING MACHINES
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machinery Co., Michigan City, Ind.

CHEMICALS
Dewey & Almy Chemical Co., Cambridge, Mass.
Glyco Products Co., Inc., New York, N. Y.

CHIMNEY BLOCK MACHINES & MOLDS
BESSER MFG. CO., Alpena, Mich.

CHUTE LINERS
Advance Foundry Co., Dayton, O.
American Manganese Steel Co., Chicago Heights, Ill.
BACON, EARLE C., Inc., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Chicago Fire Brick Co., Chicago, Ill.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
CROSS ENGR. CO., Carbondale, Pa.
FROG, SWITCH & MFG. CO., Carlisle, Pa.
Goodrich, B. F., Co., Akron, O.
GOODYEAR TIRE & RUBBER CO., INC., Akron, O.
Haiss, Geo., Mfg. Co., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg. Co., Passaic, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.

CHUTES (Bin, Concrete, Etc.)
Advance Foundry Co., Dayton, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
Atlas Car & Mfg. Co., Cleveland, O.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chain Belt Co., Milwaukee, Wis.
Chicago Bridge & Iron Co., Chicago, Ill.
Concrete Transport Mixer Co., St. Louis, Mo.
Construction Machy. Co., Waterloo, Iowa
CROSS ENGR. CO., Carbondale, Pa.
EAGLE IRON WORKS, Des Moines, Iowa
Erie Steel Constr. Co., Erie, Pa.
Fairfield Engr. Co., Marion, O.
FULLER COMPANY, Catasauqua, Pa.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
HARDINGE CO., Inc., York, Pa.
HENDRICK MFG. CO., Carbondale, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Interstate Equipt. Corp., Elizabeth, N. J.
Iowa Mfg.Co., Cedar Rapids, Iowa
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.
Johnson, C. S., Co., Champaign, Ill.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
Neff & Fry Co., The, Camden, O.
Northern Blower Co., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Works, Minneapolis, Minn.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
Richardson Scale Co., Clifton, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
ROSS SCREEN & FEEDER CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stedman's Fdy. & Machine Works, Aurora, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

CIRCUIT BREAKERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

CIRCUIT TESTERS
Atlas Powder Co., Wilmington, Del.
DU PONT, E. I., De NEMOURS & CO., Wilmington, Del.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Hercules Powder Co., Wilmington, Del.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

CLARIFIERS
Chain Belt Co., Milwaukee, Wis.
Dorr Co., Inc., The, New York, N. Y.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

CLASSIFIERS
Allen Cone & Machy. Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
American Foundry Equipt. Co., Mishawaka, Ind.
Bendelari, P. N., Joplin, Mo.
BLAW-KNOX CO., Pittsburgh, Pa.
Bradley Pulverizer Co., Allentown, Pa.
Colorado Iron Works Co., Denver, Colo.
Deister Concentrator Co., Fort Wayne, Ind.
Deister Machine Co., Fort Wayne, Ind.
Dorr Co., Inc., The, New York, N. Y.
EAGLE IRON WORKS, Des Moines, Iowa
HARDINGE CO., Inc., York, Pa.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Knickerbocker Co., The, Jackson, Mich.
LEWISTOWN FDRY & MACH. CO., Lewistown, Pa.
LINK-BELT CO., Chicago, Ill.
NORDBERG MFG. CO., Milwaukee, Wis.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Works, Inc., Minneapolis, Minn.
RAYMOND PULV. DIV., Chicago, Ill.
Research Corp., New York, N. Y.
Simplicity Engr. Co., Durand, Mich.
Sly, W. W., Mfg. Co., Cleveland, O
SMIDTH, F. L., & CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Inc., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL VIBRATING SCREEN CO., Racine, Wis.
Western Precipitation Corp., Los Angeles, Calif.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CLUTCHES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Diamond Iron Works, Minneapolis, Minn.
Dings Magnetic Separator Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Foote Bros. Gear & Machine Corp., Chicago, Ill.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Hanson Excavator Works, Div. of The Hanson Clutch & Machy. Co., Tiffin, Ohio
Jeffrey Mfg. Co., Columbus, O.
Jones, W. A., Foundry & Machine Co., Chicago, Ill.
LINK-BELT COMPANY, Chicago, Ill.
Rockford Drilling Machine, Div. of Borg Warner Corp., Rockford, Ill.
Stearns Magnetic Mfg. Co., Milwaukee, Wis.
Stephens-Admanson Mfg. Co., Aurora, Ill.
Sprout-Waldron & Co., Muncy, Pa.
Twin Disc Clutch Co., Racine, Wis.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wood's, T. B. Son Co., Chambersburg, Pa.

COAL PULVERIZING EQUIPMENT
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.
Babcock & Wilcox Co., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bradley Pulverizer Co., Allentown, Pa.
COMBUSTION ENGINEERING CORP., Chicago, Ill.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
RAYMOND PULVERIZER DIVISION, Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CONCENTRATORS
Deister Concentrator Co., Fort Wayne, Ind.
Deister Machine Co., Fort Wayne, Ind.
Dings Magnetic Separator Co., Milwaukee, Wis.
Dorr Co., Inc., The, New York, N. Y.
Ritter Products Corp., Rochester, N. Y.
Straub Mfg. Co., Inc., Oakland, Calif.

CONCRETE COLORS
Ranetite Mfg. Co., Inc., St. Louis, Mo.

CONCRETE MIXERS
ANCHOR CONCRETE MACHY. CO., Columbus, O.
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Chain Belt Co., Milwaukee, Wis.
Concrete Transport Mixer Co., St. Louis, Mo.
Construction Machinery Co., Waterloo, Iowa
Continental Motors Corp., Detroit, Mich.
Erie Steel Construction Co., Erie, Pa.
Essick Machinery Co., Los Angeles, Calif.
Foote, F. B., Foundry Co., Fredericktown, O.
GRUENDLER CRUSHER & PULVERIZER CO., St. Louis, Mo.
Independent Pneumatic Tool Co., Chicago, Ill.
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., The, Columbus, O.
KENT MACHINE CO., Cuyahoga Falls, O. (Continuous Type)
KOEHRING CO., Milwaukee, Wis.
Leach Co., The, Oshkosh, Wis.
McCarter Iron Works, Inc., Norristown, Pa.
Miller Mfg. Co., The, Jackson, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
SMITH, T. L. CO., THE, Milwaukee, Wis.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Okland, Calif.

CONCRETE PAINTS & COATINGS
Reardon Cement Co., Cincinnati, O.
Tamms Silica Co., Chicago, Ill.

CONCRETE REINFORCEMENTS (Expanded Metal)
GILMORE WIRE ROPE DIV., Muncy, Pa.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.

CONCRETE WATERPROOFING & DAMPROOFING
Billings-Chapin Co., The, Cleveland, O.

Announcement

Twenty-Second Annual Convention
NATIONAL CRUSHED STONE ASSOCIATION

In conjunction with which will be held

THE MANUFACTURERS' DIVISION EXPOSITION OF MACHINERY, EQUIPMENT, AND SUPPLIES

NETHERLAND PLAZA HOTEL
CINCINNATI, OHIO

JANUARY 30, 31 AND FEBRUARY 1, 1939

The Annual Convention of the National Crushed Stone Association, during the years since its inception, has become recognized as an event of outstanding significance to crushed stone producers individually and to the industry as a whole.

It serves, as no other medium can, to develop, crystalize, and express industry opinion. It signifies solidarity of purpose and the ablity of those engaged in the same line of activity to unite in the solution of common problems.

As individuals, producers will find much to reward them for a visit to Cincinnati. Speakers of outstanding reputation and experience will discuss problems of timely interest, both technical and legislative; opportunity will be afforded for the mutually beneficial exchange of opinions with fellow-producers, to say nothing of the pleasure to be derived from renewing old acquaintanceships; the Manufacturers' Division Exposition will command studious attention for the helpful suggestions to be obtained from an inspection of the latest developments and improvements in machinery and equipment used in the crushed stone industry.

All crushed stone producers of the United States and Canada, whether or not members of the National Crushed Stone Association, are cordially invited to attend our Twenty-second Annual Convention. Make your plans now to be present at Cincinnati on January 30, 31 and February 1, 1939.

NATIONAL CRUSHED STONE ASSOCIATION
1735 FOURTEENTH STREET N. W. . . WASHINGTON, D. C.

Directory of Manufacturers' Products

Harshaw Chem. Co., The, Cleveland, O.
Metasap Chemical Co., Inc., Harrison, N. J.
Ranetite Mfg. Co., Inc., St. Louis, Mo.
Reardon Cement Co., The, Cincinnati, O.
Tamms Silica Co., Chicago, Ill.

CONTROL SYSTEMS (Temperature, Pressure)

Bailey Meter Co., Cleveland, O.
Brown Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Taglabue Mfg. Co., C. J. Brooklyn, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

CONTROLLERS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Fairbanks, Morse & Co., Chicago, Ill.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Electric Mfg. Co., E. Pittsburgh, Pa.

CONVERTERS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Century Electric Co., St. Louis, Mo.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

CONVEYOR IDLERS & ROLLS

AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Chain Belt Co., Milwaukee, Wis.
Diamond Iron Wrks., Inc., Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Fairfield Engineering Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., The, Columbus, O.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Wrks., Inc., Minneapolis, Minn.
Portable Machy. Co., York, Pa.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Wood's, T. B., Sons Co., Chambersburg, Pa.

CONVEYORS (Apron)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Brady Conveyors Corp., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo. Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Kork-Pettit Wire Fabrics & Iron Works, Inc., Philadelphia, Pa.
LINK-BELT CO., Chicago, Ill.
Link-Track Engr. Co., Chicago, Ill.
Palmer-Bee Co., Detroit, Mich.
ROBINS CONVEYING BELT CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Union Chain & Mfg. Co., The, Sandusky, O.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

CONVEYORS (Drag-Chain)

Brady Conveyors Corp., Chicago, Ill.
Diamond Iron Works, Minneapolis, Minn.
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
Portable Machinery Co., York, Pa.
Sprout-Waldron Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS (Belt)

Allen-Sherman-Hoff Co., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON-EARLE C., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Brady Conveyor Corp., Chicago, Ill.
Brewer, H., & Co., Tecumseh, Mich.
Burmeister, L., Co., Milwaukee, Wis.
Cement Mill Equipment Co., Detroit, Mich.
Chain Belt Co., Milwaukee, Wis.
Chicago Steel Fdry. Co., Chicago, Ill.
Diamond Iron Works, Inc., Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
DRACCO CORP., Cleveland, O.
Fairfield Engr. Co., Marion, O.
FULLER CO., Catasauqua, Pa.
GAY, RUBERT M., Div., Kingston, N. Y.
General Conveyor & Mfg. Co., St. Louis, Mo.
GILMORE WIRE ROPE DIV., Muncy, Pa.
Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., Inc., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Holmes, Robert & Bros., Inc., Danville, Ill.
Huron Industries, Inc., Alpena, Mich.
Industrial Brownhoist Corp., Cleveland, O.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., The, Columbus, O.
JONES AND LAUGHLIN STEEL CORP., Muncy, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Kork-Pettit Wire Fabrics & Iron Works, Inc., Philadelphia, Pa.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LEWISTOWN FOUNDRY & MACHINE CO., Lewistown, Pa.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
MULTIPLEX CONCRETE MACHINERY CO., Elmore, Ohio
Neff & Fry Co., The, Camden, O.
New Holland Machine Co., New Holland, Pa.
Palmer-Bee Co., Detroit, Mich.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engineering Works, Inc., Minneapolis, Minn.
Polysius Corp., Bethlehem, Pa.
Portable Machinery Co., York, Pa.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
SMITH ENGINEERING WORKS, Milwaukee, Wis.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
SYNTRON CO., Homer City, Pa.
Toepfer, W., & Sons Co., Milwaukee, Wis.
TRAYLOR ENGINEERING CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL ROAD MACHINERY CO., Kingston, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.
Webster Mfg. Co., Tiffin, Ohio
WICKWIRE-SPENCER STEEL CO., New York, N. Y.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CONVEYORS (Hydro-Vacuum)

Allen-Sherman-Hoff Co., Philadelphia, Pa.

CONVEYORS (Monorail)

Cleveland Crane & Engineering Co., Wickliffe, Ohio
Godfrey Conveyor Co., Elkhart, Ind.
Louden Machinery Co., Fairfield, Iowa
Palmer-Bee Co., Detroit, Mich.

CONVEYORS (Overhead)

Chain Belt Co., Milwaukee, Wis.
Godfrey Conveyor Co., Elkhart, Ind.
Palmer-Bee Co., Detroit, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS (Pan)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., The, Columbus, Ohio.
LINK-BELT CO., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS (Pneumatic)

Brady Conveyors Corp., Chicago, Ill.
DRACCO CORP., Cleveland, Ohio
Federal Pneumatic Systems, Inc., Chicago, Ill.
FULLER CO., Catasauqua, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Holly Pneumatic Systems, Inc., New York, N. Y.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Northern Blower Co., Cleveland, Ohio
Parsons Engr. Corp., Cleveland, Ohio
Polysius Corp., Bethlehem, Pa.
RAYMOND PULV. DIV., Chicago, Ill.

CONVEYORS (Portable)

AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.
BARBER-GREENE CO., Aurora, Ill.
Brewer, H., & Co., Tecumseh, Mich.
Diamond Iron Works, Minneapolis, Minn.
Fairfield Engineering Co., Marion, Ohio
FULLER CO., Catasauqua, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., The, Columbus, Ohio
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Pioneer Engineering Works, Inc., Minneapolis, Minn.
Portable Machy. Co., York, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa

CONVEYORS (Screw)

Bartlett, C. O., & Snow Co., Cleveland, Ohio
BESSER MFG. CO., Alpena, Mich.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Brady Conveyors Corp., Chicago, Ill.
Cement Mill Equipment Co., Detroit, Mich.
Chain Belt Co., Milwaukee, Wis.
EAGLE IRON WORKS, Des Moines, Iowa
Fairfield Engr. Co., Marion, O.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., Inc., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
La-Del Conveyor & Mfg Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
Northern Blower Corp., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS (Trolley)

Chain Belt Co., Milwaukee, Wis.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
Palmer-Bee Co., Detroit, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.

CONVEYORS (Vibrating)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
SYNTRON CO., Homer City, Pa.

CONVEYOWEIGHTS

Richardson Scale Co., Clifton, N. Y.

COOLERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Co., Detroit, Mich.
Bartlett & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Cement Mill Equipment Co., Detroit, Mich.
Chicago Bridge & Iron Co., Chicago, Ill.
Christe Co., L. B., Pittsburgh, Pa.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Lime & Hydrate Plants Co., York, Pa.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
McGann Mfg. Co., Inc., York, Pa.
Northern Blower Co., Cleveland, O.
Polysius Corp., Bethlehem, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

COOLERS (Clinker)

FULLER CO., Catasauqua, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

CORRECTING BASINS

SMIDTH, F. L., & CO., New York, N. Y.

COUPLINGS (Flexible & Shaft)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Erie Pump & Engine Works, Medina, N. Y.
Falk Corp., The, Milwaukee, Wis.
Farrel-Birmingham Co., Inc., Birmingham, Ala.
Foote Bros. Gear & Machine Corp., Chicago, Ill.
Gears & Forgings, Inc., Cleveland, O.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Huron Industries, Inc., Alpena, Mich.
James, D. O., Mfg. Co., Chicago, Ill.
Jones, W. A., Foundry & Machine Co., Chicago, Ill.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Lovejoy Flexible Coupling Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.
Ottumwa Iron Works, Ottumwa, Iowa
Palmer-Bee Co., Detroit, Mich.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMITH, T. L., Co., Milwaukee, Wis.
Sprout, Waldron & Co., Muncy, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Union Chain & Mfg. Co., The, Sandusky, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wood's, T. B., Sons & Co., Chambersburg, Pa.

CRANES (Diesel, Electric, Gasoline, Steam)

American Hoist & Derrick Co., St. Paul, Minn.
Atlas Car & Mfg. Co., Cleveland, O.
AUSTIN-WESTERN ROAD MACHY. CO., THE, Aurora, Ill.
Bay City Shovels, Inc., Bay City, Mich.
Browning Crane & Shovel Co., The, Cleveland, Ohio.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Byers Machine Co., Ravenna, O.
Cleveland Crane & Engineering Co., Wickliffe, O.
Clyde Iron Works, Inc., Duluth, Minn.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Erie Steel Construction Co., Erie, Pa.
General Excavator Co., Marion, O.
Hanson Excavator Works, Division of The Hanson Clutch & Machinery Co., Tiffin, O.
Harnischfeger Corp., Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Insley Mfg. Co., Indianapolis, Ind.
KOEHRING CO., Milwaukee, Wis.
Le Tourneau, R. G., Inc., Peoria, Ill.
Lewis-Shepard Sales Corp., Watertown, Mass. (Portable)
LIMA LOCOMOTIVE WORKS (Shovel & Crane Div.), Lima, O.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGINEERING WORKS, Manitowoc, Wis.
Marion Steam Shovel Co., Marion, O.
Michigan Power Shovel Co., Benton Harbor, Mich.
NORTHWEST ENGINEERING CO., Chicago, Ill.
Ohio Locomotive Crane Co., The, Bucyrus, O.
Osgood Co., Marion, O.
Palmer-Bee Co., Detroit, Mich.
THEW SHOVEL CO., THE, Lorain, O.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
Whiting Corp., Harvey, Ill.

CRANES (Overhead Traveling)

Cleveland Crane & Engineering Co., Wickliffe, O.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Erie Steel Constr. Co., Erie, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
Louden Machinery Co., Fairfield, Iowa
Northern Engineering Wks., Detroit, Mich.
Palmer-Bee Co., Detroit, Mich.
Whiting Corp., Harvey, Ill.

CRANES (Tractor)

AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.
Bay City Shovels, Inc., Bay City, Mich.
Harnischfeger Corp., Milwaukee, Wis.
KOEHRING CO., Milwaukee, Wis.
LIMA LOCOMOTIVE WORKS, INC., (Shovel & Crane Div.), Lima, O.
LINK-BELT CO., Chicago, Ill.

CRANES (Truck)

Atlas Car & Mfg. Co., Cleveland, O.
Bay City Shovels, Inc., Bay City, Mich.
Browning Crane & Shovel Co., The, Cleveland, O.
Harnischfeger Corp., Milwaukee, Wis.
Insley Mfg. Co., Indianapolis, Ind.
Le Tourneau, R. G., Inc., Peoria, Ill.
Thew Shovel Co., The, Lorain, O.

CRAWLER ATTACHMENTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bay City Shovels, Inc., Bay City, Mich.
Harnischfeger Corp., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.
Link-Track Engr. Co., Chicago, Ill.
Streich, A. & Bro. Co., Oshkosh, Wis.

CRAWLING TRACTOR EXCAVATORS

Austin-Western Road Mach Co., Aurora, Ill.
General Excavator Co., Marion, O.
KOEHRING CO., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.

The LEADERS Will Meet Again . . .

Representative contractors, products manufacturers, and ready-mixed concrete operators—the leaders in the Concrete Industry—always welcome new sales and merchandising ideas. They want to learn about and employ new methods and devices that will increase efficiency and lower costs.

Each year an increasing number of the aggressive executives get together and discuss intimately their common business problems. Their big get-together for 1939 will consist of

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The following Conventions . . .

AMERICAN CONCRETE CONTRACTORS ASSOCIATION
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THIRD ANNUAL CONCRETE INDUSTRIES EXPOSITION
IN CHICAGO, FEBRUARY 7, 8, 9, 1939

When you participate in these great events—this educational program—you make one of the finest investments possible for yourself and your organization.

Everything is planned in advance, so you **save** time. In one place you see, inspect, the most comprehensive exhibit of concrete machinery, equipment, devices, and methods that represent the ingenuity of the best brains in your industry.

By all means plan now to meet with the other alert, aggressive business men in your industry. Come and increase your knowledge of time-saving, profit-making methods of genuine value to you. Grasp the opportunity of intimately discussing your problems with fellow contractors and products manufacturers. See...Inspect...Compare the various products that will help you to successfully shape your operating practices for 1939.

Concrete Industries Exposition and Conventions

Sherman Hotel, February 7, 8, 9, 1939

Exposition Offices: 400 West Madison Street, Chicago, Illinois

Directory of Manufacturers' Products

Osgood Co., Marion, O.
Thew Shovel Co., Lorain, O.

CRUSHER PARTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alloy Cast Steel Co., Marion, O.
Alloy Steel & Metals Co., Los Angeles, Calif.
American Manganese Steel Co., Chicago Heights, Ill.
AMERICAN PULVERIZER CO., St. Louis, Mo.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Buchanan, C. G., Co., Inc., New York, N. Y.
Commercial Steel Casting Co., Marion, O.
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
Eagle Electric Wheel Co., Quincy, Ill.
EAGLE IRON WORKS, Des Moines, Iowa
Electric Steel Fdry. Co., Portland, Ore.
FROG, SWITCH & MFG. CO., THE, Carlisle, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
National Bearing Metals Corp., St. Louis, Mo.
Pennsylvania Crusher Co., Philadelphia, Pa.
Pettibone Mulliken Corp., Chicago, Ill.
Pioneer Engineering Works, Inc, Minneapolis, Minn.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
Taylor Forge & Pipe Wrks., Chicago, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
TRAYLOR ENGINEERING MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
Weaver Mfg. Co., Los Angeles, Calif.

CRUSHERS (Cone)

NORDBERG MFG. CO., Milwaukee, WIWs.

CRUSHERS (Hammer)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AMERICAN PULV. CO., St. Louis, Mo.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bartlett, C. O. & Snow Co., Cleveland, O.
Birdsboro Steel Foundry & Mach. Co., Birdsboro, Pa.
Bradley Pulv. Co., Allentown, Pa.
BROOKS EQUIPMENT & MFG. CO., Knoxville, Tenn.
Carnegie-Illinois Steel Co., Pittsburgh, Pa. (U. S. Steel Corp. Subsi.)
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsi.)
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
Electric Steel Fdry. Co., Portland, Ore.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Pennsylvania Crusher Co., Philadelphia, Pa.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
Straub Mfg. Co., Inc., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRSHERS (Jaw & Gyratory

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alloy teel & Metals Co., Los Angeles, Calif.
AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Birdsboro Steel Fdry. Machine Co., Birdsboro, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
BROOKS EQUIPMENT & MFG CO., Knoxville, Tenn.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
Diamond Iron Works, Inc., Minneapolis, Minn.
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
Gay, Robert M., Div., Kingston, N. Y.
Good Roads Machinery Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LEWISTOWNN FDRY. & MACHINE CO., Lewistown, Pa.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
New Holland Machine Co., New Holland, Pa.
NORDBERG MFG. CO., Milwaukee, Wis.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
Pioneer Engineering Wrks., Inc., Minneapolis, Minn.
Polysius Corp., Bethlehem, Pa.
SMITH ENGINEERING WORKS, Milwaukee, Wis.
Straub Mfg. Co., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
Traylor Engineering & Mfg. Co., Allentown, Pa.
UNIVERSAL ROAD MACHINERY CO., Kingston, N. Y.
Weaver Mfg. Co., Los Angeles, Calif.
Webb City & Carterville Fdry. & Mach. Works, Webb City, Mo.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHERS (Laboratory)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AMERICAN PULVERIZER CO., St. Louis, Mo.
BACON, EARLE C., INC., New York, N. Y.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
STURTEVANT MILL CO., Boston, Mass.
Traylor Engineering & Mfg. Co., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHERS (Primary Breakers)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y. (Portable Grinders)
Continental Motors Corp., Detroit, Mich.
INGERSOLL-RAND CO., New York, N. Y. (Portable Grinders)
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y. (Portable Grinders)
SMITH ENGR. WORKS, Milwaukee, Wis.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHERS (Reduction)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN RD. MACHY. CO., Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Buchanan, C. G., Co., Inc., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Columbus, O.
SMITH ENGR. WORKS, Milwaukee, Wis.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.

CRUSHERS (Ring)

AMERICAN PULV. CO., St. Louis, Mo.
Bartlett, C. O., & Snow Co., Cleveland, O.
DIXIE MACHINERY MFG. CO., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHERS (Roll)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alloy Steel & Metals Co., Los Angeles, Calif.
AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill.
AMERICAN PULV. CO., St. Louis, Mo.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Babcock & Wilcox Co., New York, N. Y.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Brewer, H. & Co., Tecumseh, Mich.
BROOKS EQUIPMENT & MFG. CO., Knoxville, Tenn.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
Diamond Iron Wks, Inc., Minneapolis, Minn.
EAGLE IRON WKS., Des Moines, Ia.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
New Holland Machine Co., New Holland, Pa.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
Pettibone Mulliken Corp., Chicago, Ill.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMITH ENGR. WKS., Milwaukee, Wis.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
Straub Mfg. Co., Oakland, Calif.
STURTEVANT MILL CO, Boston, Mass.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
Vulcan Iron Works., Wilkes Barre, Pa.
Weaver Mfg. Co., Los Angeles, Calif.
WWelch, F. M. Engr. Service, Greenville, O.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHING ROLLS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Babcock & Wilcox Co., New York, N. Y.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Brewer, H. & Co., Tecumseh, Mich.
Colorado Iron Works Co., Denver, Colo.
Diamond Iron Works, Minneapolis, Minn.
EAGLE IRON WKS., Des Moines, Iowa
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Jeffrey Mfg. Co., Columbus, O.
Kenny-Van Saun Mfg. & Eng. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
New Holland Machine Co., New Holland, Pa.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
Pioneer Engr. Wks., Minneapolis, Minn.
STURTEVANT MILL CO, Boston, Mass.
Straub Mfg. Co., Oakland, Calif.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
Webb City & Cartervillo Fdy. & Mach. Works, Webb City, Mo.
Welch, F. M., Engr. Service, Greenville, O.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CRUSHING & SCREENING PLANTS (Portable)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Div., Chicago Heights, Ill.
AMERICAN PULV. CO., St. Louis, Mo.
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
BACON, EARLE C., CO., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
BLAW-KNOX CO, Pittsburgh, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
BROOKS EQUIPMENT & MFG. CO., Knoxville, Tenn.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
Deister Concentrator Co., Ft. Wayne, Ind.
Diamond Iron Works, Inc., Minneapolis, Minn.
DIXIE MACHY. MFG. CO., St. Louis, Mo.
EAGLE IRON WORKS, Des Moines, Iowa
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Heltzel Steel Form & Iron Co., Warren, O.
Jeffrey Mfg. Co., The, Columbus, O.
Iowa Mfg. Co., Cedar Rapids, Iowa
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
PENNSYLVANIA CRUSHER CO., Philadelphia, Pa.
Pioneer Engr. Works, Inc., Minneapolis, Minn.
SMITH ENGR. WORKS, Milwaukee, Wis.
Stedman's Fdry. & Mch. Co., Aurora, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
TYLER, W. S., CO., Cleveland, O.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL VIBRATING SCREEN CO., Racine, Wis.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

CURING RACKS

BESSER MFG. CO., Alpena, Mich.
Blystone Mfg. Co., Cambridge Springs, Pa.
Chase Fdry. & Mfg. Co., Columbus, O.
MULTIPLEX CONCRETE MACHY CO., Elmore, O.
Stearns Mfg. Co., Adrian, Mich.

DECKS, VIBRATING SCREEN

HENDRICK MFG. CO., Carbondale, Pa.

DEDUSTERS

BLAW-KNOX CO., Pittsburgh, Pa.
Pangborn Corp., Hagerstown, Md.
Western Precipitation Co., Los Angeles, Calif.

DEHYDRATORS

Pioneer Engr. Works, Inc., Minneapolis, Minn.

DERRICKS

American Hoist & Derrick Co., St. Paul, Minn.
Clyde Iron Works, Inc., Duluth, Minn.
Harnischfeger Corp., Milwaukee, Wis.
HAYWARD CO., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Wellman Engr. Co. (G. H. Williams), Cleveland, O.

DETONATOR BOXES

Mine Safety Appliances Co., Pittsburgh, Pa.

DETONATORS

Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., Cleveland, O.
DU PONT DE NEMOURS, E. I., & CO., Wilmington, Del.
ENSIGN-BICKFORD CO., Simsbury, Conn.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
National Powder Co., Eldred, Pa.

DEWATERING EQUIPMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Deister Concentrator Co., Fort Wayne, Ind.
Diamond Iron Works, Minneapolis, Minn.
Dorr Co., Inc., New York, N. Y.
EAGLE IRON WORKS, Des Moines, Iowa
Erie Pump & Engine Works, Medina, Pa.
Good Roads Machy. Corp., Kennett Square, Pa.
HARDINGE CO., INC., York, Pa.
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Peerless Pumps Div. of The Food Machy. Corp., Los Angeles, Calif.
MORRIS MACHINE WORKS, Baldwinsville, N. Y.
Schneible, Claude B., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

DIAPHGRAMS (Rubber)

Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodall Rubber Co., Philadelphia, Pa.
Goodrich, B. F. Co., Akron, O
JAEGER MACHINE CO., Columbus, O.
Manhattan Rubber Mfg. Div., Passaic, N. J.
Quaker City Rubber Co., Philadelphia, Pa.

DIPPERS AND TEETH (Dredge & Shovel)

American Manganese Steel Co., Chicago Heights, Ill.
Birdsboro Steel Fdry. & Machine. Co., Birdsboro, Pa.
Buchanan, C. G., & Co., Inc., Birdsboro, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
FROG, SWITCH & MFG. CO., Carlisle, Pa.
General Excavator Co., Marion, O.
Harnischfeger Corp., Milwaukee, Wis.
Insley Mfg. Co., Indianapolis, Ind.
KENSINGTON STEEL CO., Chicago, Ill.
KOEHRING CO., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.
Link-Track Engineering Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Osgood Co., Marion, O.
Pettibone-Mulliken Co., Chicago, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High BRIDGE, N. J.
THEW SHOVEL CO., Lorain, O.

DISINTEGRATORS

Bartlett, C. O., & Snow Co., Cleveland, O.
Brewer, H. & Co., Tecumseh, Mich.
SMIDTH, F. L., & CO., New York, N. Y.
Stedman's Fdy. & Mach. Co., Aurora, Ind.

DITCHERS

BARBER-GREENE CO., Aurora, Ill.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Continental Motors Corp., Detroit, Mich.
Harnischfeger Corp., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.

DRAGLINE & CABLE EXCAVATORS

American Cable Co., New York, N. Y.
American Hoist & Derrick Co., St. Paul, Minn.
American Steel & Wire Co., New York, N. Y. (U. S. Steel Corp. Subsi.)
AUSTIN-WESTERN ROAD MACHY. CO., Aurora, N. Y.
Bay City Shovels, Inc., Bay City, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp., Subsi.)
AUTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bay City Shovels, Inc., Bay City, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis
Columbia Steel Co, San Francisco, Calif. (U. S. Steel Corp., Subsi.)
Continental Motors Corp., Detroit, Mich.
Diamond Iron Works, Minneapolis, Minn.
Erie teel Const. Co., Erie, Pa.
General Excavator Co., Marion, O.
Harnischfeger Corp., Milwaukee, Wis.
Hazard Wire Rope Co., Wilkes-Barre, Pa.
Insley Mfg. Co., Indianapolis, Ind.
Interstate Equip. Corp., Elizabeth, N. J.
Jackson & Church Co., Saginaw, Mich.
KOEHRING CO., Milwaukee, Wis.
LIMA LOCOMOTIVE WORKS, INC. (Shovel & Crane Div.), Lima, O.
LINK-BELT CO., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
Michigan Power Shovel Co., Benton Harbor, Mich.
NORTHWEST ENGR. CO., Chicago, Ill.
Nove Engine Co., Lansing, Mich.
Osgood Co., Marion, O.
Page Engr Co, Chicago, Ill

Directory of Manufacturers' Products

Pioneer Engineering Works, Inc, Minneapolis, Minn
SAUERMAN BROS., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
THEW SHOVEL CO., Lorain, O.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

DREDGE CUTTER HEADS & LADDERS

American Steel Dredge Co., Fort Wayne, Ind.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Buchanan Co., Inc., C. G., Birdsboro, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
EAGLE IRON WORKS, Des Moines, Iowa
HETHERINGTON & BERNER INC., Indianapolis, Ind
Lawrence Machine & Pump Corp., Lawrence, Mass.
Pettibone Mulliken Corp., Chicago, Ill.
Porter, H. K., Inc., Everett, Mass.

DREDGE HULLS

American Steel Dredge Co., Fort Wayne, Ind.
Chicago Bridge & Iron Co., Chicago, Ill.
EAGLE IRON WORKS, Des Moines, Iowa
MANITOWOC ENGR. WORKS, Manitowoc, Wis.

DREDGE SLEEVES

Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodrich, B. F., & Co., Akron, O.
HETHERINGTON & BERNER, INC. Indianapolis, Ind.
Manhattan Rubber Co., Passaic, N. J.
Quaker City Rubber Co., Philadelphia, Pa.
Thermoid Rubber Co., Trenton, N. J.
U. S. Rubber Products, Inc., New York, N. Y.

DREDGES

American Hoist & Derrick Co., St. Paul, Minn
American Steel Dredge Co, Fort Wayne, Ind.
Bay City Shovels, Inc., Bay City, Mich.
Birdsboro Steel Foundry & Mach. Co., Birdsboro, Pa.
Buchanan, C. G. Co., Inc., Birdsboro, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
EAGLE IRON WORKS, Des Moines, Iowa
Ellicott Mach. Corp., Baltimore, Md.
HAYWARD CO., New York, N. Y.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Lawrence Machine Pump Corp., Lawrence, Mass.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Marion Steam Shovel Co., Marion, O.
Morris Machine Works, Baldwinsville, N. Y.
Osgood Co., Marion, O.
Straub Mfg. Co., Inc., Oakland, Calif.
Welch, F. M., Engr Service, Greenville, O.

DRILL BIT FACING METALS

Armite Laboratories, Los Angeles, Calif.

DRILL BITS

BUCYRUS-ERIE CO., South Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
Crucible Steel Co., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.
TIMKEN ROLLER BEARING CO., Canton, O.

DRILL HANDLES (Rubber)

Tyler Rubber Co., Andover, Mass.

DRILL SHARPENING MACHINES

Alloy Steel & Metals Co., Los Angeles, Calif.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Gardner-Denver Co., Quincy, Ill.
Hardsoog Wonder Drill Co., Ottumwa, Iowa
INGERSOLL-RAND CO., New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.
Sullivan Machy. Co., Michigan City, Ind.

DRILL STEEL

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Crucible Steel Co. of America, New York, N. Y.
Gardner-Denver o., Quincy, Ill.
Hardsoog Wonder Drill Co., Ottumwa, Iowa
Independent Pneumatic Tool Co., Chicago, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.
Worthington Pump & Machy. Corp., Harrison, N. J.

DRILL STEEL HEAT TREATING MACHINES

INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.
Worthington Pump & Machy. Corp., Harrison, N. J.

DRILLING ACCESSORIES

BUCYRUS-ERIE CO., South Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Gardner-Denver Co., Quincy, Ill.
Hardsoog Wonder Drill Co., Ottumwa, Iowa
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N. Y.
Loomis Machine Co., Tiffin, O.
Mine & Smelter Supply Co., Denver, Colo.
Sanderson Cyclone Drill Co., Orrville, O.
Star Drilling Machine Co., Akron, O.
TIMKEN ROLLER BEARING CO., Canton, O.

DRILLS (Blast Hole)

BUCYRUS-ERIE CO., South Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Gardner-Denver Co., Quincy, Ill.
INGERSOLL-RAND CO., New York, N. Y.

DRILLS (Hand Hammer)

Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Gardner-Denver Co., Quincy, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.

DRILLS (Rock)

BUCYRUS-ERIE CO., South Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., Cleveland, O.
Cochise Rock Drill Mfg. Co., Los Angeles, Calif.
Crucible Steel Co. of America, New York, N. Y.
Gardner-Denver Co., Quincy, Ill.
Hardsoog Wonder Drill Co., Ottumwa, Iowa
Hossfield Mfg. Co., Winona, Minn.
Independent Pneumatic Tool Co., Chicago, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Keystone Driller Co., The, Beaver Falls, Pa.
Longyear, E. J., Co., Minneapolis, Minn.
Loomis Machine Co., Tiffin, O.
Sanderson Cyclone Drill Co., Orrville, O.
Schramm, Ira, West Chester, Pa.
Star Drilling Machine Co., Akron, O.
Sullivan Machy. Co., Michigan City, Ind.
SYNTRON CO., Homer City, Pa.
TIMKEN ROLLER BEARING CO., Canton, O.
Worthington Pump & Mchy. Corp., Harrison, N. J.

DRILLS (Tripod)

Chicago Pneumatic Tool Co., New York, N. Y.
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.

DRILLS (Wagon)

Chicago Pneumatic Tool Co., New York, N. Y.
Gardner-Denver Co., Quincy, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Sullivan Machinery Co., Michigan City, Ind.

DRILLS (Well)

BUCYRUS-ERIE CO., South Milwaukee, Wis.
Electric Wheel Co., Quincy, Ill.
Loomis Machine Co., Tiffin, O.

DRIVES (Belt, Chain & Rope)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
Diamond Iron Works, Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairfield Engr. Co., Marion, O. (Chain)
Haiss, Geo., Mfg. Co., New York, N. Y. (Chain)
Jeffrey Mfg. Co., Columbus, O.
Jones, W. A. Fdy. & Machine Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y. (Crain)
LINK-BELT CO., Chicago, Ill.
Medart Co., St. Louis, Mo.
Rockwood Mfg. Co., Indianapolis, Ind.
SMIDTH, F. L., & CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whitney Chain & Mfg. Co., Hartford, Conn. (Chain)
Wood's Sons Co., T. B., Chambersburg, Pa.
Worthington Pump & Machy. Corp., Harrison, N. J.

DRIVES (Short-Center)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Bodinson Mfg. Co., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
SMIDTH, F. L. & CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.

DRIVES (Worm)

Cleveland Worm & Gear Co, Cleveland, O.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, O.
LINK-BELT CO., Chicago, Ill.
James, D. O., Mfg. Co., Chicago, Ill.
National Bearing Metals Corp., St. Louis, Mo.

DRYERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bartett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
Christie, L. R., Co., Pittsburgh, Pa.
Colorado Iron Works Co., Denver, Colo.
COMBUSTION ENGR. CO., Chicago, Ill.
GRUENDLER CRUSHER & PULVERIZER CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LEWISTOWN FDY. & MACH. CO., Lewistown, Pa.
Lime & Hydrate Plants Co., York, Pa.
LINK-BELT CO., Chicago, Ill.
McCarter Iron Works, Inc., Norristown, Pa.
McGann Mfg. Co., York, Pa.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Polysius Corp., Bethlehem, Pa.
RAYMOND PULV. DIV., Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
TYLER, W. S., CO., Cleveland, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Warren Bros. Roads Co., Boston, Mass.
Western Precipitation Co., Los Angeles, Calif.
White Mfg. Co., Elkhart, Ind.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

DUAL REAR DRIVES

Thornton-Tandem Co., Detroit, Mich.

DUST ARRESTORS

BLAW-KNOX CO., Pittsburgh, Pa.
Connecticut Blower Co., Hartford, Conn.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Western Precipitation Corp., Los Angeles, Calif.

DUST COLLECTING SYSTEMS

Allen-Sherman-Hoff Co., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
American Foundry Equip. Co., Mishawaka, Ind.
Bartlett, C. O., & Snow Co., Cleveland, O.
Binks Mfg. Co., Chicago, Ill.
BLAW-KNOX CO., Pittsburgh, Pa.
Buell Engineering Co., Inc., New York, N. Y.
Buremeister, L., Co., Milwaukee, Wis.
By-Products Recoveries, Inc., New York, N. Y.
Clark Dust Control Co., Chicago, Ill.
Chicago Bridge & Iron Co., Chicago, Ill.
Connecticut Blower Co., Hartford, Conn.
DRACCO CORP., Cleveland, O.
Federal Pneumatic Systems, Inc., Chicago, Ill.
HENDRICK MFG. CO., Carbondale, Pa.
Holly Pneumatic Systems, Inc., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Korb-Pettit Wire Fabrics & Iron Works, Inc., Philadelphia, Pa.
Lime & Hydrate Plants Co., York, Pa.
Markley Dust Control Systems, Inc., New York, N. Y.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O
Polysius Corp., Bethlehem, Pa.
Prat-Daniel Corp., Port Chester, N. Y.
RAYMOND PULV. DIV., Chicago, Ill.
Research Corp., New York, N. Y.
Schneible, Claude B., Co., Chicago, Ill.
Sly, W. W., Mfg. Corp., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
STURTEVANT MILL CO., Boston, Mass.
Union Iron Works, Inc., Erie, Pa.
Western Precipitation Co., Los Angeles, Calif.
Whiting Corp., Harvey, Ill.

DUST COLLECTOR BAGS

American Fdy. Equip. Co., Mishawaka, Ind.
Bemis Bro. Bag Co., St. Louis, Mo.
BLAW-KNOX CO., Pittsburgh, Pa.
Filter Media Corp., New York, N. Y.
Pangborn Corp., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Sly, W. W., Mfg. Co., Cleveland, O.

DUST CONVEYING SYSTEMS

Allen-Sherman-Hoff Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Clark Dust Control Co., Chicago, Ill.
Connecticut Blower Co., Hartford, Conn.
DRACCO CORP., Cleveland, O.
FULLER CO., Catasauqua, Pa.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
RAYMOND PULV. DIV., Chicago, Ill.
Schneible, Claude B., Co., Chicago, Ill.
Sly, W. W., Mfg. Co., Cleveland, O.
Western Precipitation Co., Los Angeles, Calif.

DUST FILTERS

Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Western Precipitation Corp., Los Angeles, Calif.

DUST PRECIPITATORS

Pangborn Corp., Hagerstown, Md.
Research Corp., New York, N. Y.
Western Precipitation Co., Los Angeles, Calif.

DUST RECOVERY PLANTS

Parsons Engineering Corp., Hagerstown, Md.
Schneible, Claude B., Co., Chcago, Ill.
Sly, W. W., Mfg. Co., Cleveland, O.
Western Precipitation Co., Los Angeles, Calif.

DYNAMITE

Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., New York, N. Y.
du Pont de Nemours, E. I. & Co., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.

ELECTRIC CABLES

GENERAL ELECTRIC CO., Schenectady, N. Y.
Okonite Co., The, Passaic, N. J.

ELECTRIC MOTORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Electric Motors Co., Cedarburg, Wis.
Century Electric Co., Milwaukee, Wis.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Fairbanks, Morse & Co., Chicago, Ill.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
HAYWARD CO., New York, N. Y.
Lincoln Electric Co., Cleveland, O.
Reliance Elec. & Eng. Co., Cleveland, O.
U. S. Electrical Motors Inc., Los Angeles, Calif.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilson, K. B., Buffalo, N. Y.

ELECTRIC MOTOR STARTERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
GENERAL ELEC. CO., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTROSTATIC SEPARATORS

Ritter Products Corp., Rochester, N. Y.

ELEVATORS

Allen-Sherman-Hoff Co., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN ROAD MCHY. CO., Aurora, N. Y.
BACON, EARLE C., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Barrett-Cravens Co., Chicago, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Brady Conveyors Corp., Chicago, Ill.
Burmeister, L., Co., Milwaukee, Wis.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Chicago Steel Fdry. Co., Chicago, Ill.
Clyde Iron Works, Inc., Duluth, Minn.
CROSS ENGR. CO., Carbondale, Pa.
Diamond Iron Works, Inc., Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
DRACCO CORP., Cleveland, O.
EAGLE IRON WORKS, Des Moines, Iowa
Fairfield Engr. Co., Marion, O.
FULLER CO., Catasauqua, Pa.
GAY, RUBERT M., DIV., Kingston, N. Y.
General Conveyor & Mfg. Co., St. Louis, Mo.
Good Roads Machy. Co., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis Mo.
Haiss, Geo., Mfg. Co., Inc., New York, N. Y.
HENDRICK MFG. CO., Carbondale, Pa.
Holmes, Robert & Bros., Inc., Danville, Ill.
Huron Industries, Inc., Alpena, Mich.
Industrial Brownhoist Corp., Cleveland, O.
Iowa Mfg. Co., Cedar Rapids, Iowa
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
KENT MACHINE CO., Cuyahoga Falls, O.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LEWISTOWN FDY. & MACHINE CO., Lewistown, Pa.

Directory of Manufacturers' Products

LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Miles Mfg. Co., Jackson, Mich.
MULTIPLEX CONCRETE MCHY. CO., Elmore, O.
Neff & Fry Co., The, Camden, O.
New Holland Machine Co., New Holland, Pa.
Pioneer Engr. Works, Inc., Minneapolis, Minn.
Portable Mchy. Co., York, Pa.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. Y.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
SMITH ENGR. WORKS, Milwaukee, Wis.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
SYNTRON CO., Homer City, Pa.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Webster Mfg. Co., Tiffin, O.
Welch, F. M., Engr. Service, Greenville, O.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

ENGINEERS (Designing & Consulting)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Arnold & Sons, Woodville, O.
ARNOLD & WEIGEL, INC., Woodville, O.
BACON, EARLE C., INC., New York, N. Y.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
BLAW-KNOX CO., Pittsburgh, Pa.
Bradley Pulverizer Co., Allentown, Pa.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
Christie, L. B., & Co., Pittsburgh, Pa.
Dorr Co., Inc., New York, N. Y.
FULLER CO., Catasauqua, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Holmes, Robt., & Bros., Inc., Danville, Ill.
Interstate Equipment Corp., Elizabeth, N. J.
Iowa Mfg. Co., Cedar Rapids, Ia.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Lime & Hydrate Plants Co., York, Pa.
LINK-BELT CO., Chicago, Ill.
Long, M. A., Co., Baltimore, Md.
Longyear, E. J., Co., Minneapolis, Minn.
MacDonald Engr. Co., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Medart Co., St. Louis, Mo.
MERRICK SCALE CO., Passaic, N. J.
Morris Machine Works, Baldwinsville, N. Y.
Neff & Fry Co., The, Camden, O.
Northern Blower Co., Cleveland, O.
Productive Equip. Corp., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Standard Oil Co. (Ind.), Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
STURTEVANT MILL CO., Boston, Mass.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.
Webster Mfg. Co., Tiffin, O.
Welch, F. M., Engr. Service, Cleveland, O
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.
Wood, R. D., & Co., Philadelphia, Pa.

ENGINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., Chicago, Ill.
Climax Engr. Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Continental Motors Corp., Detroit, Minn.
Cooper-Bessemer Corp., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Delaware Machine & Tool Co., Muncie, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Hercules Motors Corp., Canton, O.
INGERSOLL-RAND CO., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Ia.
Le Roi Co., Milwaukee, Wis.
Murphy Diesel Co., Ltd., Milwaukee, Wis.
National Supply Co., Toledo, O.
New Holland Machine Co., New Holland, Pa.
NORDBERG MFG. CO., Milwaukee, Wis.
Novo Engine Co., Lansing, Mich.
Orr & Sembower, Inc., Reading, Pa.
Power Mfg. Co., Marion, O.
Superior Diesel, Toledo, O.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson, E. B., Buffalo, N. Y.
Wisconsin Motor Corp., Milwaukee, Wis
Worthington Pump & Machy. Corp., Harrison, N. J.

ENGINES (Natural Gas)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Climax Engr. Co., Chicago, Ill.

ENGINES (Steam)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
American Hoist & Derrick Co., St. Paul, Minn.
Dake Engine Co., Grand Haven, Mich.
INGERSOLL-RAND CO., New York, N. Y.
Morris Machine Works, Baldwinsville, N. Y.
NORDBERG MFG. CO., Milwaukee, Wis.
Troy Engine & Machine Co., Troy, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

EXHAUSTERS

COMBUSTION ENGR. CO., Chicago, Ill.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Quaker City Rubber Co., Philadelphia, Pa.
RAYMOND PULV. DIV., Chicago, Ill.

EXPLOSIVES

Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., New York, N. Y.
DU PONT, E. I., DE NEMOURS & CO., Wilmington, Del.
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
Independent Explosives Co., Cleveland, O.

FANS (Exhaust & Ventilating)

American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Binks Mfg. Co., Chicago, Ill.
BLAW-KNOX CO., Pittsburgh, Pa.
Connecticut Blower Co., Hartford, Conn.
GENERAL ELECTRIC CO., Schenectady, N. Y.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Prat-Daniel Corp., Port Chester, N. Y.
Sly, W. W., Mfg. Co., Cleveland, O.
SMIDTH, F. L., & CO., New York, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

FEEDERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
ARNOLD & WEIGEL, INC., Woodville, O.
Babcock & Wilcox Co., New York, N. Y.
BACON, EARLE C., INC., New York, N. Y.
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO, Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Bradley Pulverizer Co., Allentown, Pa.
Brewer, H., & Co., Tecumseh, Mich.
Chain Belt Co., Milwaukee, Wis.
Deister Concentrator Co., Fort Wayne, Ind.
Diamond Iron Works, Inc., Minneapolis, Minn.
Erie Steel Construction Co., Erie, Pa.
Fairfield Eng. Co., Marion, O.
FULLER CO., Catasauqua, Pa.
Gallagher Co., Salt Lake City, Utah
GAY, ROBERT M., DIV., Kingston, N. Y.
General Conveyor & Mfg. Co., St. Louis, Mo.
Good Roads Machy. Co, Kennett Square, Pa.
GRENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Huron Industries Co., Alpena, Mich.
Iowa Mfg. Co., Cedar Rapids, Ia.
Jackson & Church Co., Saginaw, Mich.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg & Eng Corp. New York, N. Y
KENT MACHINE CO., Cuyahoga Falls, O.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
Link-Track Engr. Co., Chicago, Ill.
MERRICK SCALE MFG. CO., Passaic, N. J.
Miles Mfg. Co., Jackson, Mich
Mine & Smelter Supply Co, Denver, Colo.
Northern Blower Co., Cleveland, O.
PENNSYLVANIA CRSHER CO., Philadelphia, Pa.
Pioneer Engr. Wks., Minneapolis, Minn.
Polysius Corp., Bethlehem, Pa.
Richardson Scale Co., Clifton, N. J.
Riddell, W. A., Corp., Bucyrus, O.
ROBINS CONVEYING BELT CO., New York, N. Y.
ROSS SCREEN & FEEDER CO., New York, N. Y.
SCHAFFER POIDOMETER CO., Pittsburgh, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
SMITH ENGINEERING WKS., Milwaukee, Wis
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Inc., Oakland, Calif
SYNTRON CO., Homer City, Pa.
TRAYLOR ENG. & MFG. CO., Allentown, Pa.
UNIVERSAL CRUSHER CO., Cedar Rapids, Ia.
UNIVERSAL ROAD MCHY. CO., Kingston, N. Y.
Webster Mfg. Co., Tiffin, O.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

FILTER CLOTH

American Foundry Equip. Co., Mishawaka, Ind.
DRACCO CORP., Cleveland, O.
Filter Media Corp., New York, N. Y.
Northern Blower Co., Cleveland, O.
Oliver United Filters, Inc., New York, N. Y.
Pangborn Corporation, Hagerstown, Md.
Parsons Engineering Corp., Cleveland, O.
Roebling's, John A., Sons Co., Trenton, N. J.
TYLER, W. S., CO., Cleveland, O.
WICKWIRE SPENCER STEEL CO., New York, N. Y.

FIRE EXTINGUISHERS

American-LaFrance-Foamite Corp., Elmira, N. Y.

FIRST AID SUPPLIES

Davis Emergency Equipment Co., New York, N. Y.
Mines Safety Appliance Co., Pittsburgh, Pa.

FLOOR SWEEPING SYSTEMS (Hydro-Vacuum)

Allen-Sherman-Hoff Co., Philadelphia, Pa.

FLOORING (Steel Grating)

Kerlow Steel Flooring Co., Jersey City, N. J.

FLOWER POT MOLDS (Concrete)

Florist Pot Co., The, Gibbsboro, N. J.

FORGES

Gardner-Denver Co., Quincy, Ill.
Worthington Pump & Machy. Corp., Harrison, N. J.

FORGE HAMMERS

Bradley, C. C., & Son, Inc., Syracuse, N. Y.

FORGINGS

Allis-Chalmers Mfg Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Coates Steel Products Co, Greenville, Ill.
Continental Motors Corp., Detroit, Mich.
Gears & Forgings, Inc., Cleveland, O.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.

FORM CLAMPS

Neptune Mfg. Co., Los Angeles, Calif.

FROGS & SWITCHES

Atlas Car & Mfg. Co., Cleveland, O
Central Frog & Swith Co., Cincinnati, O.
Easton Car & Const. Co., Easton, Pa.
Foster, L. B. Co., Pittsburgh, Pa.
Frog, Switch & Mfg. Co., Carlisle, Pa.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

FUELS (Diesel)

TEXAS CO., New York, N. Y.

FUSES (Detonating & Safety)

Atlas Powder Co., Wilmington, Del.
Burton Explosives, Inc., New York, N. Y.
ENSIGN-BICKFORD CO., Simsbury, Conn.
Halafax Explosives Co., Los Angeles, Calif.
Hercules Powder Co., Wilmington, Del.
National Powder Co., Eldred, Pa.

FURNACES (Heat Treating, Electric)

GENERAL ELECTRIC CO., Schenectady, N. Y.

FUSE CUTOUTS

GENERAL ELECTRIC CO., Schenectady, N. Y.

FUSE CUTTERS

ENSIGN-BICKFORD CO., Simsbury, Conn.

FUSES (Electric)

GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

FUSE LIGHTERS

ENSIGN-BICKFORD CO., Simsbury, Conn.

GALVANOMETERS

Atlas Powder Co., Wilmington, Del.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Hercules Powder Co., Wilmington, Del.

GASKETS

Cincinnati Rubber Mfg. Co., Cincinnati, O.
Goodrich, B. F. Co., Akron, O.
GOODYEAR TIRE & RUBBER CO., INC., Akron, O.
Hewitt Rubber Corp., Buffalo, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., San Francisco, Calif.
Manhattan Rubber Mfg. Co., Passaic, N. J.
National Bearing Metals Corp., St. Louis, Mo.
New York Belting & Packing Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
Republic Rubber Co., Youngstown, O.
United States Rubber Products, Inc., New York, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GASOLINE

GULF REFINING CO., Pittsburgh, Pa.
Socony-Vacuum Oil Co., New York, N. Y.
Standard Oil Co. (Ind), Chicago, Ill.
TEXAS CO., New York, N. Y.

GAS PRODUCERS

BLAW-KNOX CO., Pittsburgh, Pa.
Wellman Engineering Co., Cleveland, O.

GEAR-MOTORS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
Falk Corp., Milwaukee, Wis.
GENERAL ELECTRIC CO., Schenectady, N. Y.
LINK-BELT CO., Chicago, Ill.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GEARS

Abart Gear & Machine Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Buchanan, C. G., Co., Inc., Birdsboro, Pa.
Chain Belt Co., Milwaukee, Wis.
Cleveland Worm & Gear Co., Cleveland, O.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Iron Wks., Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
Falk Corp., Milwaukee, Wis.
Farrel-Birmingham Co. Inc., Birmingham, Ala.
Foote Bros. Gear & Mach. Corp., Chicago, Ill.
FROG, SWITCH & MFG. CO., Carlisle, Pa.
Gears & Forgings, Inc., Cleveland, O.
General Conveyor & Mfg. Co., St. Louis, Mo
GENERAL ELECTRIC CO., Schenectady, N. Y.
Haiss, Geo., Mfg. Co., New York, N. Y.
Huron Industries, Inc., Alpena, Mich.
James, D. O., Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., The, Columbus, O.
Jones, W. A., Fdry. & Mach. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
KENSINGTON STEEL CO., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.
Ottumwa Iron Works, Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.
Pettibone Mulliken Corp., Chicago, Ill.
Philadelphia Gear Works, Philadelphia, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TAYLOR WHARTON IRON & STEEL CO., High Bridge, N. J.
TRAYLOR ENG. & MFG. CO., Allentown, Pa.
Twin Disc Clutch Co., Racine, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GENERATOR & MOTOR GENERATOR SETS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Atlas Car & Mfg. Co., Cleveland, O.
Century Electric Co., St. Louis, Mo.
Climax Engr. Co., Chicago, Ill.
Continental Motors Corp., Detroit, Mich.
Cooper-Bessemer Corp., Mt. Vernon, O.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Fairbanks, Morse & Co., Chicago, Ill.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
INGERSOLL-RAND CO., New York, N. Y.
Le Roi Co., Milwaukee, Wis.
Murphy Diesel Co., Ltd., Milwaukee, Wis.
National Supply Co., Toledo, O.
NORDBERG MFG. CO., Milwaukee, Wis.
Superior Diesel, Toledo, O.
SYNTRON CO., Homer City, Pa.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Wilson, E. B., Buffalo, N. Y.

GLASS SAND EQUIPMENT

LEWISTOWN FDRY. & MACH. CO., Lewistown, Pa.

GLOVES

Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co, Cleveland, O.

CROSS
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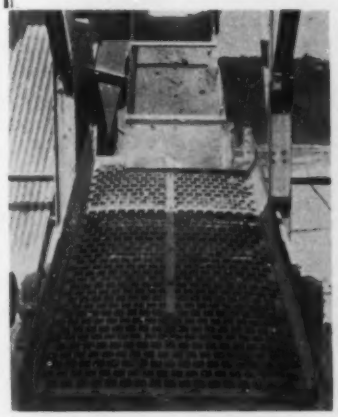
FOR VIBRATING, ROTARY, AND SHAKING SCREENS



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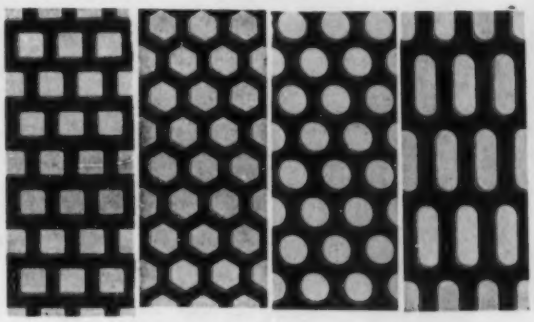

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Directory of Manufacturers' Products

GOGGLES
Davis Emergency Equipment Co., New York, N. Y.
General Scientific Equipment Co., North Philadelphia, Pa.
Goggle Parts Co., The, Cleveland, O.
Lincoln Electric Co., Cleveland, O.
Linde Air Products Co., New York, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa
Pulmosan Safety Equipment Corp., Brooklyn, N. Y.
Weldit Acetylene Co., Detroit, Mich.

GRAPPLES
BLAW-KNOX CO., Pittsburgh, Pa.
BUCYRUS-ERIE CO., So. Milwaukee, Wis.
Erie Steel Const. Co., Erie, Pa.
HAYWARD CO., New York, N. Y.
Owen Bucket Co., Cleveland, O.
Wellman Engineering Co.,(G. H. Williams), Cleveland, O.

GRATING
ARNOLD & WEIGEL, INC., Woodville, O.
BLAW-KNOX CO., Pittsburgh, Pa.
EAGLE IRON WKS., Des Moines, Iowa
HENDRICK MFG. CO., Carbondale, Pa.

GREASE
Albany Grease Co., New York, N. Y.
Alemite Corp., Chicago, Ill.
BACON, EARLE, C., INC., New York, N. Y.
Dixon Crucible, Jos., Co, Jersey City, N. J.
Fiske Bros. Refining Co., Newark, N. J.
Gredag Corp., The, Niagara Falls, N. Y.
GULF REFINING CO., Pittsburgh, Pa.
Perola, Inc., Pittsburgh, Pa.
Socony-Vacuum Oil Co., Inc., New York, N. Y.
Standard Oil Co. (Ind.), Chicago, Ill.
TEXAS CO., New York, N. Y.

GREASE CUPS
Alemite Corp., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
ROBINS CONVEYING BELT CO., New York, N. Y.
Wood's, T. B., Sons Co., Chambersburg, Pa.

GREASE GUNS
Alemite Corp., Chicago, Ill.

GREENHOUSE BENCH FORMS (Concrete)
Mead-Suydam Co., Orange, N. J.

GRIZZLIES
See Screens (Grizzly)

GRINDING AIDS
Dewey & Almy Chemical Co., Cambridge, Mass.
Sullivan Machy. Co., Michigan City, Ind. (Grinders)

GUARDS (Lamp)
Flexible Steel Lacing Co., Chicago, Ill.

GUARDS (Machinery)
Bartlett, C. O. & Snow Co., Cleveland, O.
HARRINGTON & KING PERF. CO., Chicago, Ill.
HENDRICK MFG. CO., Carbondale, Pa.
Korb-Pettit Fabrics & Iron Wks., Inc., Philadelphia, Pa.
Manganese Steel Forge Co., Philadelphia, Pa.
National Wire Cloth Co., Inc., St. Paul, Minn.
Superior Body Co., Inc., Marion, Ind.
TYLER, W. S., CO., Cleveland, O.

GUNS (Hydraulic & Spray)
Binks Mfg. Co., Chicago, Ill. (Spray)
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Morris Machine Wks., Baldwinsville, N. Y.
Naylor Forge & Pipe Wks., Chicago, Ill.

GYPSUM PLANTS
Erie Steel Const. Co., Erie, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Jaite Co., Jaite, O.
Kennedy-Van Saun Mfg. & Eng., Corp., New York, N. Y.
Neff & Fry Co., The, Camden, O.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

HANGERS, ANCHORS & INSERTS (Concrete)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Jeffrey Mfg. Co., The, Columbus, O.
LINK-BELT CO., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

HAULAGE SYSTEMS (Remote Control)
Atlas Car & Mfg. Co., Cleveland, O.
DEMPSTER BROS., INC., Knoxville, Tenn.
GENERAL ELEC. CO., Schenectady, N. Y.
KOEHRING CO., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

HAULAGE SYSTEMS (Electric)
Atlas Car & Mfg. Co., Cleveland, O.
Erie Steel Construction Co., Erie, Pa.
GENERAL ELEC. CO., Schenectady, N. Y.
Jeffrey Mfg. Co., The, Columbus, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

HEATERS (Bitumen)
Easton Car & Const. Co., Easton, Pa.

HELMETS
American Fdry. Equipment Co., Mishawaka, Ind.
Goggle Parts Co., The, Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Co., Cleveland, O.
Sly, W. W. Mfg. Co., Cleveland, O.

HOISTS (Chain, Electric, Skip, Portable, Air, Etc.)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hoist & Derrick Co., St. Paul, Minn.
American Steel Dredge Co., Ft. Wayne, Ind.
Atlas Car & Mfg. Co., Cleveland, O.
Bartlett, C. O. & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
Brewer, H. & Co., Tecumseh, Mich.
Chain Belt Co., Milwaukee, Wis.
Chase Fdry. & Mfg. Co., Columbus, O.
Chicago Pneumatic Tool Co. New York, N. Y.
Cleveland Crane & Eng. Co., Wickliffe, O.
Clyde Iron Wks., Inc., Duluth, Minn.
COMMERCIAL SHEARING & STAMPING CO., Youngstown, O.
Construction Machinery Co., Waterloo, Ia.
Continental Motors Corp., Detroit, Mich.
Curtis Pneumatic Machy. Co., St. Louis, Mo.
Dake Engine Co., Grand Haven, Mich.
Diamond Iron Wks., Minneapolis, Minn.
EAGLE IRON WKS., Des Moines, Ia.
Easton Car & Const. Co., Easton, Pa.
Essick Machy. Co., Los Angeles, Calif.
Fairbanks, Morse & Co., Chicago, Ill.
Fairfield Eng. Co., Marion, O.
Gardner-Denver Co., Quincy, Ill.
Gay, Rupert M., Div., Kingston, N. Y.
Godfrey Conveyor Co., Elkhart, Ind.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Harnischfeger Corp., Milwaukee, Wis.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
INGERSOLL-RAND CO., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Iowa Mfg. Co., Cedar Rapids, Ia.
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Lawrence Mach. & Pump Corp., Lawrence, Mass.
Le Tourneau, R. G., Peoria, Ill.
Lime & Hydrate Plants Co., York, Pa.
LINK-BELT CO., Chicago, Ill.
Louden Machinery Co., Fairfield, Ia.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
NORDBERG MFG. CO., Milwaukee, Wis.
Northern Eng. Wks., Detroit, Mich.
Novo Engine Co., Lansing, Mich.
NORTHWEST ENGR. CO., Chicago, Ill.
Ottumwa Iron Wks., Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
ROBINS CONVEYING BELT CO., New York, N. Y.
St. Paul Hydraulic Hoist Co., St. Paul, Minn.
SAUERMAN BROS., Chicago, Ill.
SMITH ENGR. WKS., Milwaukee, Wis.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sterling Machy. Corp., Kansas City, Mo.
Stroudsburg Engine Wks., Stroudsburg, Pa.
Sullivan Machy. Co., Michigan City, Ind.
Superior Body Co. Inc., Marion, Ind.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Vulcan Iron Wks., Wilkes-Barre, Pa.
Webster Mfg. Co., Tiffin, O.
Welch, F. M., Engr. Service, Greenville, O.

HOISTING ENGINES
Clyde Iron Wks., Inc., Duluth, Minn.

HOPPERS
Atlas Car & Mfg. Co., Cleveland, O.
Austin-Western Road Machy. Co., Aurora, Ill
Bartlett, C. O. & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
BLAW-KNOX CO., Pittsburgh, Pa.
Butler Bin Co., Waukesha, Wis.
Chain Belt Co., Milwaukee, Wis.
Chicago Bridge & Iron Co., Chicago, Ill.
Erie Steel Const. Co., Erie, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
GAY, RUPERT M. DIV., Kingston, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
HENDRICK MFG. CO., Cabrondale, Pa.
JAEGER MACHINE CO., Columbus, O.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
Merrick Scale Co., Passaic, N. J.
Miles Mfg. Co., Jackson, Mich.
Neff & Fry Co., The, Camden, O.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
Portable Machy. Co., York, Pa.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. J.
Richardson Scale Co., Clifton, N. J.
ROBINS CONVEYING BELT CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Superior Body Co., Marion, Ind.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.
UNIVERSAL ROAD MACHINERY CO., Kingston, N. Y.
Webster Mfg. Co., Tiffin, O.

HOSE (Air Drill, Water, Steam, Sand Suction & Discharge)
Binks Mfg. Co., Chicago, Ill.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Pneumatic Tool Co., New York, N. Y.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Cleveland Rock Drill Co., Cleveland, O.
DIXIE MACHINERY CO., St. Louis, Mo.
Firestone Tire & Rubber Co., Akron, O.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Goodrich, B. F., Co., Akron, O.
Goodyear Tire & Rubber Co., Inc., Akron, O.
Hardsoog Wonder Drill Co., Ottumwa, Ia.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Hewitt Rubber Corp., Buffalo, N. Y.
INGERSOLL-RAND CO., New York, N. Y.
JAEGER MACHINE CO., Columbus, O.
Linde Air Products Co., New York, N. Y.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Morris Machine Wks., Baldwinsville, N. Y.
New York Belting & Packing Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.
Republic Rubber Div., Youngstown, O.
Self-Vulcanizing Rubber Co., Inc., Chicago, Ill.
Sly, W. W., Mfg. Co., Cleveland, O.
Sullivan Mchy. Co., Michigan City, Ind.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Products, Inc., New York, N. Y.

HOSE CLAMPS
Chicago Pneumatic Tool Co., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
INGERSOLL-RAND CO., New York, N. Y.

HOSE COUPLINGS
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Pneumatic Tool Co., New York, N. Y.
Cleveland Rock Drill Co., The, Cleveland, O.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Goodall Rubber Co., Inc., Philadelphia, Pa.
Goodrich, B. F., Co., Akron, O.
Hewitt Rubber Corp., Buffalo, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Manitowoc Engineering Works, Manitowoc, Wis.
New York Belting & Packing Co., New York, N. Y.
Republic Rubber Co., Youngstown, O.
Sullivan Machinery Co., Michigan City, Ind.
U. S. Rubber Products, Inc., New York, N. Y.
Worthington Pump & Machy. Corp., Harrison, N. J.

HOSE (Sand Blast)
Cincinnati Rubber Co., Cincinnati, O.
Pangborn Corp., Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.
Sly, W. W., Mfg. Co., Cleveland, O.

HYDRATORS (Lime)
ARNOLD & WEIGEL, INC., Woodville, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
HARDINGE CO., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Kritzer Co., Chicago, Ill.
Lime & Hydrate Plants Co., York, Pa.
McGann Mfg. Co., Inc., York, Pa.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

HYDRAULIC BRAKES, INDUSTRIAL
Wagner Electric Corp., St. Louis, Mo.

INSULATORS, VIBRATION (Rubber)
Goodrich, B. F., Co., Akron, O.
Tyler Rubber Co., Andover, Mass.

INTERCOOLERS (Air)
Young Radiator Co., Racine, Wis.

JACKS
Joyce-Cridland Co., The, Chicago, Ill.

JIGS (Sand & Gravel)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bendelari, F. N., Joplin, Mo.
HARDINGE CO., INC., York, Pa.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

JOISTS & SLAB MACHINES (Concrete)
BESSER MFG. CO., Alpena, Mich. (Vibrators)
R & L Concrete Machinery Co., Kendallville, Ind.

KEROSENE
Standard Oil Co. (Ind.), Chicago, Ill.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
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Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
BLAW-KNOX CO., Pittsburgh, Pa.
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Chicago Steel Fdry. Co., Chicago, Ill.
Cement Mill Equipment Co., Detroit, Mich.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp, New York, N. Y.
Manitowoc Engr. Wks., Manitowoc, Wis.
SMIDTH, F. L. & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

KILNS (Rotary)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co, Chicago, Ill.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
McGann Mfg. Co., Inc., York, Pa.
Polysius Corp., Bethlehem, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGINEERING & MFG. CO., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

KILNS (Shaft)
ARNOLD & SON, Woodville, O.
ARNOLD & WEIGEL, INC., Woodville, O.
Hardinge Co., Inc., York, Pa.
Lime & Hydrate Plants Co., York, Pa.

KILNS (Vertical)
ARNOLD & SON, Woodville, O.
ARNOLD & WEIGEL, INC., Woodville, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Vulcan Iron Works, Wilkes-Barre, Pa.

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Babcock & Wilcox Co., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.

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SMIDTH, F. L., & CO., New York, N. Y.

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HARDINGE CO., INC., York, Pa.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

KOMINUTERS
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Brown Instrument Co., Philadelphia, Pa.
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Gallgher Co., Salt Lake City, Utah
Humbuldt Mfg. Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Mine & Smelter Supply Co., Denver, Colo.
Pyrometer Instrument Co., New York, N. Y.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
Sargent, E. H., & Co., Chicago, Ill.
SMIDTH, F. L., & CO., New York, N. Y.
Tagliabue, C. J., Mfg. Co., Brooklyn, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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Stephens-Adamson Mfg. Co., Aurora, Ill.

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Barrett-Cravens Co., Chicago, Ill.
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Fiam, Stephen, Sherman Oaks, Calif.
Stearns Mfg. Co., Adrian, Mich.

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FULLER CO., Catasauqua, Pa.
HARDINGE CO., INC., York, Pa.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., The, Columbus, O.
LINK-BELT CO., Chicago, Ill.
RAYMOND PULV. DIV., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

LIME PLANTS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AMERICAN PULVERIZER CO., St. Louis, Mo.
ARNOLD & WEIGEL, INC., Woodville, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
Erie Steel Constr. Co., Erie, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
MANITOWOC ENGR. WORKS, Manitowoc, Wis.
Neff & Fry Co., The, Camden, O.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

LIME PUTTY PLANTS
Chicago Bridge & Iron Co., Chicago, Ill.
Potts, C. & G., Co., Indianapolis, Ind.

LIME SPREADERS
Peoria Steel & Wire Co., Inc., Peoria, Ill.

LOADERS (CAR, TRUCK, BIN & HOPPER)
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BESSER MFG. CO., Alpena, Mich.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Chain Belt Co., Milwaukee, Wis.
Continental Motors Corp., Detroit, Mich.
Diamond Iron Works, Minneapolis, Minn.
Fairfield Engr. Co., Marion, O.
FULLER CO., Catasauqua, Pa.
GAY, HUBERT M. DIV., Kingston, N. Y.
Gardner-Denver Co., Quincy, Ill.
General Conveyor & Mfg. Co., St. Louis, Mo.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HAISS, GEO., MFG. CO., INC., New York, N. Y.
Jeffrey Mfg. Co., The, Columbus, O.
LINK-BELT CO., Chicago, Ill.
Link-Track Engr. Co., Chicago, Ill.
Marion Steam Shovel Co., Marion, O.
New Holland Machine Co., New Holland, Pa.
NORTHWEST ENGR. CO., Chicago, Ill.
Osgood Co., Marion, O.
Portable Machy. Co., York, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
ROSS SCREEN & FEEDER CO., New York, N. Y.
Sprout, Waldron & Co., Inc., Muncy, Pa.
Stearns Mfg. Co., Adrian, Mich.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sullivan Machy. Co., Michigan City, Ind.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Wellman Engr. Co. (G. H. Williams), Cleveland, O.

LOADERS (Bont)
Chain Belt Co., Milwaukee, Wis.
FULLER CO., Catasauqua, Pa.
LINK-BELT CO., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

LOADERS (Box Car)
BARBER-GREENE CO., Aurora, Ill.
Brady Conveyors Corp., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Diamond Iron Works, Minneapolis, Minn.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., The, Columbus, O.
LINK-BELT CO., Chicago, Ill.
Link Track Engr. Co., Chicago, Ill.
Manierre Engr. & Machy. Co., Milwaukee, Wis.
Ottumwa Box Car Loader Co., Ottumwa, Iowa
Portable Machy. Co., York, Pa.
Richardson Scale Co., Clifton, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.

LOADERS (Tractor)
Hough Co., The, Chicago, Ill.
Marzel Equipt. Works, Div. of Construction Equipt. Co., Chicago, Ill.
Trackson Co., The, Milwaukee, Wis.

LOADERS (Underground)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bay City Shovels, Inc., Bay City, Mich.
BUCYRUS-ERIE CO., S. Milwaukee, Wis.
Diamond Iron Works, Minneapolis, Minn.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
NORDBERG MFG. CO., Milwaukee, Wis.
THEW SHOVEL CO., Lorain, O.

LOCOMOTIES (Diesel & Diesel-Electric)
Baldwin Locomotive Wks., The, Philadelphia, Pa.
Brookville Locomotive Co., Brookville, Pa.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Davenport-Besler Corp., Davenport, Iowa
Fate-Root-Heath Co., Plymouth, O.
Heisler Locomotive Works, Erie, Pa.
INGERSOLL-RAND CO., New York, N. Y.
LIMA LOCOMOTIVE WORKS, INC., New York, N. Y. (Locomotive Div.)
Mid-West Locomotive Works, Cincinnati, O.
Plymouth Locomotive Works, Plymouth, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Electric, Trolley & Storage Battery)
Atlas Car & Mfg. Co., Cleveland, O.
Baldwin Locomotive Works, The, Philadelphia, Pa.
Brookville Locomotive Co., Brookville, Pa.
Davenport-Besler Corp., Davenport, Iowa
GENERAL ELECTRIC CO., Schenectady, N. Y.
Heisler Locomotive Works, Erie, Pa.
Jeffrey Mfg. Co., Columbus, O.
LIMA LOCOMOTIVE WORKS, INC. (Locomotive Div.), New York, N. Y.
Mid-West Locomotive Works, Cincinnati, O.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Gasoline & Gasoline-Electric)
Atlas Car & Mfg. Co., Cleveland, O.
Baldwin Locomotive Works, Philadelphia, Pa.
Brookville Locomotive Co., Brookville, Pa.
Continental Motors Corp., Detroit, Mich.
Davenport-Besler Corp., Davenport, Iowa
Fate-Root-Heath Co., Plymouth, O.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Heisler Locomotive Works, Erie, Pa.
Jeffrey Mfg. Co., Columbus, O.
LIMA LOCOMOTIVE WORKS, INC. (Locomotive Div.), Lima, O.
Mid-West Locomotive Works, Cincinnati, O.
Plymouth Locomotive Works, Plymouth, O.
Porter, H. K., Co., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Kerosene)
Baldwin Locomotive Works, The, Philadelphia, Pa.
Brookville Locomotive Co., Brookville, Pa.
LIMA LOCOMOTIVE WORKS, INC. (Locomotive Div.), Lima, O.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Oil & Oil-Electric)
Atlas Car & Mfg. Co., Cleveland, O.
Baldwin Locomotive Works, The, Philadelphia, Pa.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fate-Root-Heath Co., Plymouth, O.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Heisler Locomotive Works, Erie, Pa.
INGERSOLL-RAND CO., New York, N. Y.
LIMA LOCOMOTIVE WORKS, INC. (Loco. Div.), Lima, O.
Mid-West Locomotive Works, Cincinnati, O.
Plymouth Locomotive Works, Plymouth, O.
Porter, H. K., Co., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVES (Steam)
Baldwin Locomotive Works, The, Philadelphia, Pa.
Brookville Locomotive Co., Brookville, Pa.
Davenport-Besler Corp., Davenport, Iowa
Heisler Locomotive Works, Erie, Pa.
LIMA LOCOMOTIVE WORKS, INC. (Loco. Div.), Lima, O.
Mid-West Locomotive Works, Cincinnati, O.
Porter, H. K., Co., Pittsburgh, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.
Whitcomb Locomotive Co., Rochelle, Ill.

LOCOMOTIVE STACK NETTING
TYLER, W. S., CO., Cleveland, O.

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Acheson Colloids Corp., Port Huron, Mich.
Albany Grease Co, New York, N. Y.
Alemite Corp., Chicago, Ill.
BACON, EARLE C., INC., New York, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Fiske Bros. Refining Co., Newark, N. J.
Gredag Corp., The, Niagara Falls, N. Y.
GULF REFINING CO., Pittsburgh, Pa.
Lunkenheimer Co., The, Cincinnati, O.
Penola, Inc., Pittsburgh, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
Socony-Vacuum Oil Co., Inc., New York, N. Y.
Standard Oil Co. (Ind.), Chicago, Ill.
TEXAS CO., THE, New York, N. Y.

LUBRICATING SYSTEMS
Alemite Corp., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.
Trabon Engr. Co., Cleveland, O.

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De Laval Steam Turbine Co., Trenton, N. J.
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INGERSOLL-RAND CO., New York, N. Y.
ROBINS CONVEYING BELT CO., New York, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
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Buchanan, C. G., Co., Inc., New York, N. Y.
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Dings Magnetic Separator Co., Milwaukee, Wis.
Exolon Co., Blaisdell, N. Y.
Huron Industries, Alpena, Mich.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
Parsons Engr. Corp., Cleveland, O.
ROBINS CONVEYING BELT CO., New York, N. Y.
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DIXIE MACHY. MFG. CO., St. Louis, Mo.
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GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Heltzel Steel Form & Iron Co., Warren, O.
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Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Engr. & Mfg. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Neff & Fry Co., The, Camden, O.
Northern Blower Co., Cleveland, O.
Palmer-Bee Co., Detroit, Mich.
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Erie Steel Constr. Co., Erie, Pa.
FULLER CO., Catasauqua, Pa.
GENERAL ELECTRIC CO., Schenectady, N. Y.
HARDINGE CO., INC., York, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
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Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

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Goodrich, B. F., Co., Akron, O.
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Manhattan Rubber Mfg. Div., The, Passaic, N. J.
Quaker City Rubber Co., Philadelphia, Pa.
Republic Rubber Co., Youngstown, O.
Thermoid Rubber Co., Trenton, N. J.
Tyler Rubber Co., Andover, Mass.
United States Rubber Products, Inc., New York, N. Y.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
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Babcock & Wilcox Co., New York, N. Y.
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Manhattan Rubber Mfg. Co., Passaic, N. J.
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United States Rubber Products, Inc., New York, N. Y.

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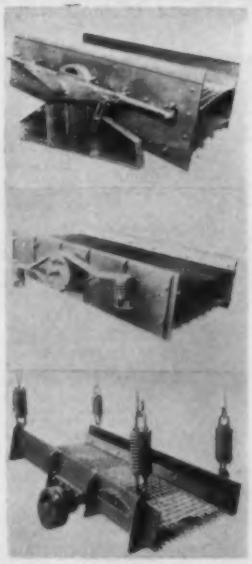

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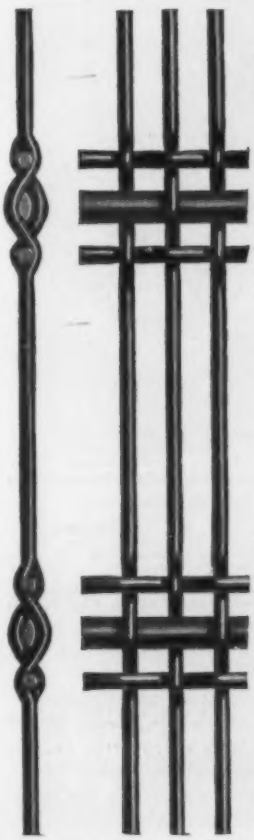

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Morris Machine Wks., Baldwinsville, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.

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Schaefer, C. M., Valve Co., Allentown, Pa.

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Curtis Pneumatic Machy. Co., St. Louis, Mo.
FULLER CO., THE, Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
INGERSOLL-RAND CO., New York, N. Y.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Peerless Pump Div. of Food Machy. Corp., Los Angeles, Calif.
Quincy Compressor Co., Quincy, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
SMIDTH, F. L. & CO., New York, N. Y.
Sullivan Machy. Co., Michigan City, Ind.

PUMPS (Dredge)
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American Manganese Steel Co., Chicago Heights, Ill.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Bennett, W. H. K., Co., Chicago, Ill.
Birdsboro Steel Fdy. & Mach. Co., Birdsboro, Pa.
Buchanan, C. O., Co., Inc., Birdsboro, Pa.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
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Ebel Hoist & Pump Co., Lansing, Mich.
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Fairbanks, Morse & Co., Chicago, Ill.
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Swaby Mfg. Co., Chicago, Ill.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Chain Belt Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
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Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
DeLaval Steam Turbine Co., Trenton, N. J.
Electric Wheel Co., Quincy, Ill.
Erie Pump & Engine Wks., Medina, N. Y.
Essick Machy. Co., Los Angeles, Calif.
Fairbanks, Morse & Co., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Gorman-Rupp Co., Mansfield, O.
INGERSOLL-RAND CO., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
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Pennsylvania Pump & Compressor Co., Easton, Pa.
Roper, Geo. D., Corp., Rockford, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Victor Equipment Co., San Francisco, Calif.
Webb City & Carterville Fdy. & Mach. Co., Webb City, Mo.
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Morris Machine Wks., Baldwinsville, N. Y.
SMIDTH, F. L., & CO., New York, N. Y.
WILFLEY, A. R., & SONS, INC., Denver, Colo.

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General Refractories Co., Philadelphia, Pa.
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Ironton Fire Brick Co., Ironton, O.
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Keasbey & Mattison Co., San Francisco, Calif.
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Bethlehem Steel Co., Bethlehem, Pa.
GILMORE WIRE ROPE DIV., Muncy, Pa.
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TEXAS CO., THE, New York, N. Y.

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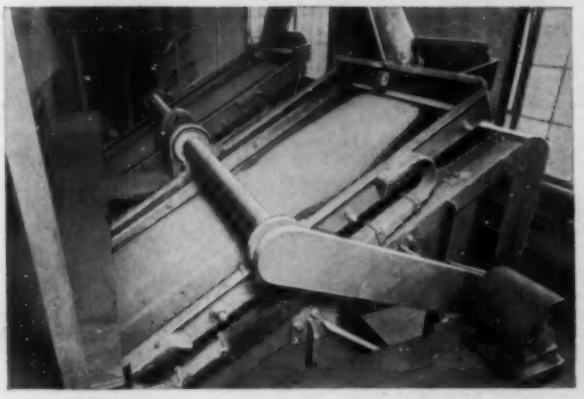

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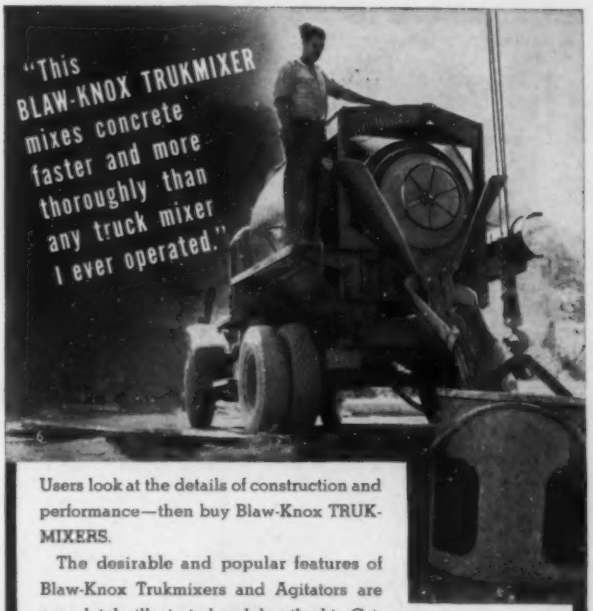

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Parsons Engr. Corp., Cleveland, O.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
ROBINS CONVEYING BELT CO., New York, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.
SMITH ENGR. WKS., Milwaukee, Wis.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
TYLER, W. S., CO., Cleveland, O.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL ROAD MACHY. CO., Kingston, N. Y.
Webster Mfg. Co., Tiffin, O.

SCREENS (Ro'ary)

La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
SMITH ENGR. WORKS, Milwaukee, Wis.

SCREENS (Scalping)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
ROBINS CONVEYING BELT CO., New York, N. Y.
SCREEN EQUIPMENT CO., INC., Buffalo, N. Y.
SMITH ENGR. WKS., Milwaukee, Wis.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

SCREENS (Trommel)

Korb-Petit Wire Fabrics & Iron Wks., Inc., Philadelphia, Pa.
LINK-BELT CO., Chicago, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Welch, F. M., Engr. Service, Greenville, O.

SCREENS (Vibrating)

Allen Cone & Machy. Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
AUSTIN-WESTERN ROAD MACHINERY CO., THE, Aurora, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O. & Snow Co., Cleveland, O.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
BROOKS EQUIPMENT & MFG. CO., Knoxville, Tenn.
Chain Belt Co., Milwaukee, Wis.
Deister Concentrator Co., The, Fort Wayne, Ind.
Deister Machine Co., Fort Wayne, Ind.
Diamond Iron Wks., Inc., Minneapolis, Minn.
EAGLE IRON WKS., Des Moines, Ia.
Good Roads Machy. Corp., Kennett Square, Pa.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
HARDINGE CO., INC., York, Pa.
HENDRICK MFG. CO., Carbondale, Pa.
Huron Industries, Inc., Alpena, Mich.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.
Korb-Pettit Wire Fabrics & Iron Wks., Inc., Philadelphia, Pa.
La-Del Conveyor & Mfg. Co., New Philadelphia, O.
Lewistown Fdry. & Mach. Co., Lewistown, Pa.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
New Holland Mach. Co., New Holland, Pa.
NORDBERG MFG. CO., Milwaukee, Wis.
Orville Simpson Co., The, Cincinnati, O.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
ROBINS CONVEYING BELT CO., New York, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.
SCREEN EQUIPMENT CO., Buffalo, N. Y.
SIMPLICITY ENGR. CO., Durand, Mich.
SMITH ENGR. WKS., Milwaukee, Wis.
Sprout Waldron & Co., Inc., Muncy, Pa.
Stedman's Fdry. & Mach. Co., Aurora, Ind.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Oakland, Calif.
STURTEVANT MILL CO., Boston, Mass.
TYLER, W. S. CO., Cleveland, O.
UNIVERSAL CRUSHER CO., Cedar Rapids, Iowa
UNIVERSAL VIBRATING SCREEN CO., Racine, Wis.
Webb City & Carterville Fdry. & Mach. Wks., Webb City, Mo.
Webster Mfg. Co., Tiffin, O.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.
WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

SCREENS (Washing)

Chain Belt Co., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.
SCREEN EQUIPMENT CO., Buffalo, N. Y.

SCREWS (Cnps, Self Locking, Set, Hollow Set)

Standard Pressed Steel Co., Jenkintown, Pa.

SCRUBBERS (Washers)

LINK-BELT COMPANY, Chicago, Ill.
SMITH ENGR. WORKS, Milwaukee, Wis.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
TYLER, W. S. CO., Cleveland, O.

SEAL RINGS

Huron Industries, Inc., Alpena, Mich.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SEARCHLIGHTS (Portable)

Mine Safety Appliances Co., Pittsburgh, Pa.

SEMI-TRAILERS, QUARRY (Side and End Dumping)

Easton Car & Constr. Co., Easton, Pa.

SEPARATORS (Abrasive)

Continental Motors Corp., Detroit, Mich.
Pangborn Corporation, Hagerstown, Md.
Parsons Engr. Corp., Cleveland, O.

SEPTIC TANK MOLDS (Concrete)

Ashland Vault Co., Ashland, O.
Automatic Sealing Vault Co., The, Peru, Ind.
Automatic Septic Tank Mold Co., Galion, O.
Baumgardner Concrete Products Co., Tiffin, O.
Bennett-Barnes Co., Terre Haute, Ind.
Suburban Sanitation Systems Co., Kingsville, O.
Unit System Septic Tanks Co., Oregon, Ill.
York Automatic Sealing Vault Co., York, Pa.

SHAFTING

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Bartlett & Snow Co., Cleveland, O.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.
Jeffrey Mfg. Co., The, Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Wood's, T. B. Sons Co., Chambersburg, Pa.

SHALE PLANERS

EAGLE IRON WORKS, Des Moines, Ia.

SHEAVES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Co., Chicago Heights, Ill.
American Steel & Wire Co., Cleveland, O. (U. S. Steel Subsidiary).
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary).
Diamond Iron Wks., Minneapolis, Minn.
Dodge Mfg. Corp., Mishawaka, Ind.
EAGLE IRON WORKS, Des Moines, Ia.
Ebel Hoist & Pump Co., Lansing, Mich.
Erie Steel Constr. Co., Erie, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo., Mfg. Co., New York, N. Y.
HETHERINGTON & BERNER, INC., Indianapolis, Ind.
Interstate Equipment Corp., Elizabeth, N. J.
Jeffrey Mfg. Co., The, Columbus, O.
Jones, W. A., Fdy. & Mach. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
McLANAHAN & STONE CORP., Hollidaysburg, Pa.
Pettibone Mulliken Corp., Chicago, Ill.
Pioneer Engr. Wks., Inc., Minneapolis, Minn.
RANSOME CONCRETE MACHINERY CO., Dunellen, N. J.
Rockwood Mfg. Co., Indianapolis, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Sanford Day Iron Wks., Knoxville, Tenn.
SAUERMAN BROS., Chicago, Ill.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sullivan Machy. Co., Michigan City, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wood's, T. B., Sons Co., Chambersburg, Pa.

SHOVELS (Compressed Air)

NORDBERG MFG. CO., Milwaukee, Wis.

SHOVELS, POWER (Diesel, Diesel-Air, Electric, Gasoline, Gas-Electric, Oil, Steam)

American Hoist & Derrick Co., St. Paul, Minn.
AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Ill.
Bay City Shovels, Inc., Bay City, Mich.
Browning Crane & Shovel Co., The, Cleveland, O.
BUCYRUS-ERIE CO., South Milwaukee, Wis.
Byers Machine Co., Ravenna, O.
General Excavator Co., Marion, O.
Hanson Excavator Wks., Div. of The Hanson Clutch & Machy. Co., Tiffin, O.
Harnischfeger Corp., Milwaukee, Wis.
Keystone Driller Co., Beaver Falls, Pa.
KOEHRING CO., Milwaukee, Wis.
Industrial Brownhoist Corp., Cleveland, O.
LIMA LOCOMOTIVE WKS., INC., Lima, O. (Shovel & Crane Div.).
LINK-BELT CO., Chicago, Ill.
Link-Track Engineering Co., Chicago, Ill.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Marion Steam Shovel Co., Marion, O.
NORTHWEST ENGR. CO., Chicago, Ill.
Michigan Power Shovel Co., Benton Harbor, Mich.
Osgood Co., Marion, O.
THEW SHOVEL CO., Lorain, O.

SHOVELS (Tractor)

AUSTIN-WESTERN ROAD MACHY. CO., Aurora, Ill.
Bay City Shovels, Inc., Bay City, Mich.
Construction Equipment Co., Elkhart, Ind.
General Excavator Co., Marion, O.
Hanson Excavator Works, Div. of the Hanson Clutch & Machy. Co., Tiffin, O.
Harnischfeger Corp., Milwaukee, Wis.
Hough Co., The, Chicago, Ill.
Insley Mfg. Co., Indianapolis, Ind.
KOEHRING CO., Milwaukee, Wis.
Le Tourneau, R. G., Inc., Peoria, Ill.
LIMA LOCOMOTIVE WKS., INC., Lima, O. (Shovel & Crane Div.)
LINK-BELT CO., Chicago, Ill.
Marvel Equipment Wks., Div. of Construction Equipt. Co., Chicago, Ill.
Osgood Co., Marion, O.
Trackson Co., The, Milwaukee, Wis.

SHOVELS (Truck)

Bay City Shovels, Inc., Bay City, Mich.
Browning Crane Shovel Co., The, Cleveland, O.
Hanson Excavator Wks., Div. of The Hanson Clutch & Machy. Co., Tiffin, O.
Hough Co., The, Chicago, Ill.
Marvel Equipment Wks., Div. of Construction Equipt. Co., Chicago, Ill.
THEW SHOVEL CO., THE, Lorain, O.
Trackson Company, The, Milwaukee, Wis.

SHOVELS (Underground)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bay City Shovels, Inc., Bay City, Mich.
Harnischfeger Corp., Milwaukee, Wis.
LIMA LOCO. WORKS, INC., (Shovel & Crane Div.), Lima, O.
NORDBERG MFG. CO., Milwaukee, Wis.
THEW SHOVEL CO., THE, Lorain, O.

SHOVEL REPAIR PARTS (Manganese)

Alloy Cast Steel Co., Marion, O.
American Manganese Steel Co., Chicago Heights, Ill.
Harnischfeger Corp., Milwaukee, Wis.
Link-Track Engr. Co., Chicago, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.

SHREDDERS

WILLIAMS PATENT CRUSHER & PULV. CO., St. Louis, Mo.

SIEVES (Testing)

HENDRICK MFG. CO., Carbondale, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
SMIDTH, F. L., & CO., New York, N. Y.
TYLER, W. S., CO., THE, Cleveland, O.

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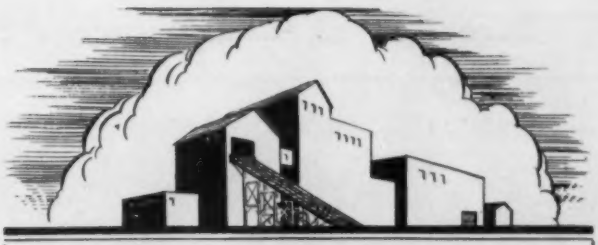

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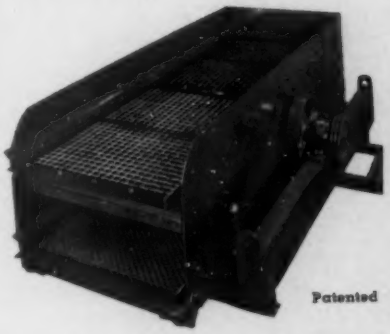

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Burrell Eng. & Const. Co., Chicago, Ill.
Chicago Bridge & Iron Co., Chicago, Ill. (Steel)
Long, M. A., Co., The, Baltimore, Md.
MacDonald Engr. Co., Chicago, Ill.
Marietta Concrete Corp., Marietta, O.
Neff & Fry Co., The, Camden, O.
SMIDTH, F. L., & CO., New York, N. Y.

SILO STAVE MACHINES (Concrete)
BESSER MFG. CO., Alpena, Mich.

SKIDS
BESSER MFG. CO., Alpena, Mich.
Chase Fdy. & Mfg. Co., Columbus, O.
Easton Car & Constr. Co., Easton, Pa.
Superior Body Co., Inc., Marion, Ind.

SLAKERS (Rotary)
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SLUGS (Grinding)
Coates Steel Products Co., Greenville, Ill.
SMIDTH, F. L., & CO., New York, N. Y.

SLURRY MIXERS
Dorr Co., Inc., The, New York, N. Y.
HARDINGE CO., INC., York, Pa.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Polysius Corp., Bethlehem, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SLURRY SEPARATORS
SMIDTH, F. L., & CO., New York, N. Y.

SLURRY THICKENERS
Dorr Co., Inc., The, New York, N. Y.
HARDINGE CO., INC., York, Pa.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
SMIDTH, F. L., & CO., New York, N. Y.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SMOKESTACKS
Chicago Bridge & Iron Co., Chicago, Ill.
HENDRICK MFG. CO., Carbondale, Pa.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
MANITOWOC ENGR. WKS., Manitowoc, Wis.
Northern Blower Corp., Detroit, Mich.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SPEED REDUCERS (Gear, Etc.)
Abart Gear & Machine Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
BACON, EARLE C., INC., New York, N. Y.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Cement Mill Equipment Co., Detroit, Mich.
Cleveland Worm & Gear Co., The, Cleveland, O.
DeLaval Steam Turbine Co., Trenton, N. J.
Fairbanks, Morse & Co., Chicago, Ill.
Falk Corp., The, Milwaukee, Wis.
Farrel-Birmingham Co., Birmingham, Ala.
Foote Bros. Gear & Machine Corp., Chicago, Ill.
Gears & Forgings, Inc., Cleveland, O.
Huron Industries, Inc., Alepna, Mich.
Iowa Mfg. Co., Cedar Rapids, Ia.
James, D. O. Mfg. Co., Chicago, Ill.
Jeffrey Mfg. Co., The, Columbus, O.
Jones, W. A., Fdy. & Mach. Co., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Ottumwa Iron Wks., Ottumwa, Ia.
Palmer-Bee Co., Detroit, Mich.
Philadelphia Gear Wks., Philadelphia, Pa.
SMIDTH, F. L., & CO., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.
Twin Disc Clutch Co., Racine, Wis.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wood's, T. B., Sons Co., Chambersburg, Pa.

SPOUTS
Advance Fdy. Co., Dayton, O.
Chain Belt Co., Milwaukee, Wis.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Haiss, Geo. Mfg. Co., Inc., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
RANSOME CONCRETE MACHY. CO., Dunellen, N. J.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
TRAYLOR ENGR. & MFG. CO., Allentown, Pa.

SPRAYS AND SPRAYING EQUIPMENT
Binks Mfg. Co., Chicago, Ill.
Continental Motors Corp., Detroit, Mich.
Deister Concentrator Co., Ft. Wayne, Ind.
LINK-BELT CO., Chicago, Ill.

SPROCKETS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Manganese Steel Div. of The Amer. Brake Shoe Fdy. Co., Chicago Heights, Ill.
BACON, EARLE C., INC., New York, N. Y.
Bartlett, C. O., & Snow Co., Cleveland, O.
Bodinson Mfg. Co., Inc., San Francisco, Calif.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Diamond Iron Wks., Inc., Minneapolis, Minn.
General Conveyor & Mfg. Co., St. Louis, Mo.
Iowa Mfg. Co., Cedar Rapids, Ia.
Jeffrey Mfg. Co., The, Columbus, O.
Jones, W. A., Fdy. & Mach. Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
KENSINGTON STEEL CO., Chicago, Ill.
LINK-BELT CO., Chicago, Ill.
Palmer-Bee Co., Detroit, Mich.
Pettibone Mulliken Corp., Chicago, Ill.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Straub Mfg. Co., Oakland, Calif.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Chain & Mfg. Co., Hartford, Conn.

STABILIZATION ADMIXTURES
Calcium Chloride Assn., Detroit, Mich.
Columbia Alkali Corp., Barberton, O.
Dow Chemical Co., Midland, Mich.
Harshaw Chemical Co., Cleveland, O.
Michigan Alkali Corp., New York, N. Y.
Solvay Sales Corp., New York, N. Y.
Tamms Silica Co., Chicago, Ill.
Victor Chemical Works, Chicago, Ill.

STABILIZATION EQUIPMENT
BARBER-GREENE CO., Aurora, Ill.
BESSER MFG. CO., Alpena, Mich.
Bonnot Co., Canton, O.
Brewer Co., Tecumseh, Mich.
Cedar Rapids Mfg. Co., Cedar Rapids, Ia.
GRUENDLER CRUSHER & PULV. CO., St. Louis, Mo.
Pioneer Engineering Wks., Minneapolis, Minn.

STANDPIPES
Chicago Bridge & Iron Co., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
ROSS SCREEN & FEEDER CO., New York, N. Y.

STEEL (Abrasive-Resisting)
American Rolling Mill Co., Middletown, O.
Crucible Steel Co. of America, New York, N. Y.
GILMORE WIRE ROPE DIV., Muncy, Pa.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.
RYERSON, JOS. T. & SON, INC., Chicago, Ill.

STEEL (Electric Furnace)
Alloy Cast Steel Co., Marion, O.
Chicago Steel Foundry Co., Chicago, Ill.
Crucible Steel Co. of America, New York, N. Y.
TIMKEN ROLLER BEARING CO., THE, Canton, O.

STEEL (Open Hearth)
American Manganese Steel Co., Chicago Heights, Ill.
American Rolling Mill Co., Middletown, O.
Commercial Steel Casting Co., Marion, O.
Crucible Steel Co. of America, New York, N. Y.
GILMORE WIRE ROPE DIV., Muncy, Pa.
JONES & LAUGHLIN STEEL CORP., Muncy, Pa.
Manganese Steel Forge Co., Philadelphia, Pa.
Pettibone Mulliken Corp., Chicago, Ill.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
TIMKEN ROLLER BEARING CO., THE, Canton, O.

STEEL (Special Alloy)
Alloy Cast Steel Co., Marion, O.
American Rolling Mill Co., Middletown, O.
Chicago Steel Foundry Co., Chicago, Ill.
Crucible Steel Co. of America, New York, N. Y.
Stoody Co., Whitter, Calif.
TIMKEN ROLLER BEARING CO., THE, Canton, O.

STEP FORMS (Concrete)
The Miles Mfg. Co., Jackson, Mich.

STOKERS
ARNOLD & WEIGEL, INC., Woodville, O.
Babcock & Wilcox Co., New York, N. Y.
COMBUSTION ENGR. CO., INC., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Fireman Mfg. Co., Cleveland, O.
LINK-BELT COMPANY, Chicago, Ill.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Whiting Corp., Harvey, Ill.

STORAGE EQUIPMENT
BARBER-GREENE CO., Aurora, Ill.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Butler Bin Co., Waukesha, Wis.
Chicago Bridge & Iron Co., Chicago, Ill.
Erie Steel Construction Co., Erie, Pa.
Fairfield Engr. Co., Marion, O.
Haiss, Geo., Mfg. Co., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Kern, Fred T., Co., Milwaukee, Wis.
LINK-BELT CO., Chicago, Ill.
Neff & Fry Co., The, Camden, O.
ROBINS CONVEYING BELT CO., New York, N. Y.
SAUERMAN BROS., INC., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.

STRIPPERS (Concrete)
ANCHOR CONCRETE MACHY. CO., Columbus, O.
BESSER MFG. CO., Alpena, Mich.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.

STUCCO COLORS
MEPHAM, GEO. S., CORP., E. St. Louis, Ill.

SWITCHBOARDS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Brown Instrument Co., Philadelphia, Pa.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

TACHOMETERS
Bailey Meter Co., Cleveland, O.
Brown Instrument Co., Philadelphia, Pa.
GENERAL ELECTRIC CO., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

TAMPERS (Power and Hand)
ANCHOR CONCRETE MACHINERY CO., Columbus, O.
BESSER MFG. CO., Alpena, Mich.
Blystone Mfg. Co., Cambridge Springs, Pa.
KENT MACHINE CO., Cuyahoga Falls, O.
MULTIPLEX CONCRETE MACHY. CO., Elmore, O.
Stearns Mfg. Co., Adrain, Mich.
SYNTRON CO., Homer City, Pa.

TANKS (Air, Storage, Etc.)
Allen Cone & Machy. Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bartlett, C. O., & Snow Co., Cleveland, O.
BLAW-KNOX CO., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Combustion Engr. Co., Inc., Chicago, Ill.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
The Dorr Co., New York, N. Y.
Eagle Iron Works, Des Moines, Ia.
HARDINGE CO., INC., York, Pa.
Heltzel Steel Form & Iron Co., Warren, O.
HENDRICK MFG. CO., Carbondale, Pa.
INGERSOLL-RAND CO., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
LINK-BELT CO., Chicago, Ill.
The Neff & Fry Co., Camden, O.
Northern Blower Co., Cleveland, O.
Parsons Engr. Corp., Cleveland, O.
Pioneer Engineering Works, Minneapolis, Minn.
Portable Machy. Co., York, Pa.
RAYMOND PULVERIZER DIV., Chicago, Ill.
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SAUERMAN BROS., INC., Chicago, Ill.
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Cleveland Tractor Co., Cleveland, O.
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Easton Car & Constr. Co., Easton, Pa.
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Gar Wood Industries, Inc., Detroit, Mich.
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Hughes-Keenan Co., Mansfield, O.
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Streich, A. & Bro. Co., Oshkosh, Wis.

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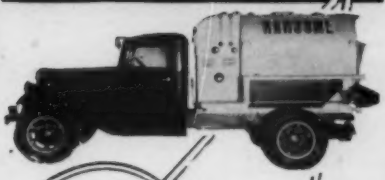

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Dorr Co., Inc., The, New York, N. Y.
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Harnischfeger Corp., Milwaukee, Wis.
Lincoln Electric Co., Cleveland, O.
Metal & Thermit Corp., New York, N. Y.
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Linde Air Products Co., New York, N. Y.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
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Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

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Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
GILMORE WIRE ROPE DIV., Muncy, Pa.
HAZARD WIRE ROPE DIV., Wilkes-Barre, Pa.
Linde Air Products Co., New York, N. Y.
JONES AND LAUGHLIN STEEL CORP., Muncy, Pa.
Manganese Steel Forge Co., Philadelphia, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
TAYLOR-WHARTON IRON & STEEL CO., High Bridge, N. J.
Weldit Acetylene Co., Detroit, Mich.
Westinghouse Elec. & Mfg Co., E. Pittsburgh, Pa.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

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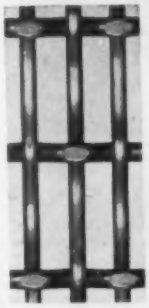
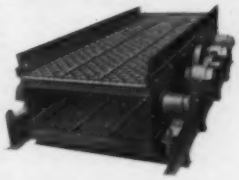
CIRCLE-THROW MECHANICALLY AND ELECTRICALLY-VIBRATED



TON-CAP



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In all Meshes and Metals

Scrubbers and Dryers

THE W. S. TYLER COMPANY
3623 Superior Avenue Cleveland, Ohio

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UNIFORM HIGH QUALITY STEELS

. . . . at No Extra Cost

Accurately controlled by definite specifications, Ryerson Certified Steels represent the highest quality obtainable in each class and type of material. Special abrasion resisting steels, perforated metals and other products for the Rock Products industry are included. A special plan on alloy steels gives the user exact data on every bar. When you need steel, phone, wire or write the nearest Ryerson plant. Immediate Shipment is assured. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

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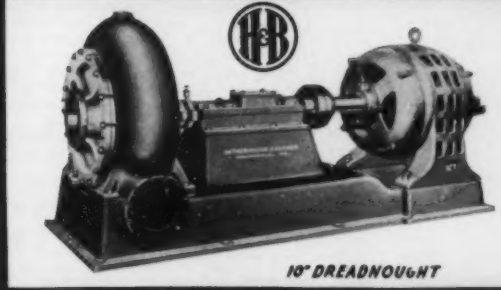
SAND *and* GRAVEL PUMPS



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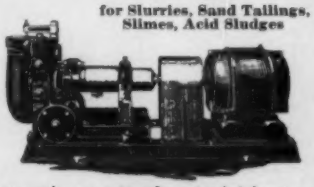
centrifugal SAND PUMPS

for Slurries, Sand Tailings, Slimes, Acid Sludges



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USE RIGHT BUCKET FOR THE JOB

Hayward makes all four—clam shell, drag-line, electric motor, orange peel. A Hayward recommendation is unprejudiced.

THE HAYWARD COMPANY
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FOR HEAVY "OUTDOOR" DRIVES

As manufacturers of **both** types of flexible belt lacing, we recommend STEELGRIP for heavy drives, conveyor belts and outdoor jobs for: (1st) It can be applied anywhere—all you need is a hammer. (2nd) It compresses and protects belt ends—prevents fraying, adds to belt life. It is flexible and easily detachable. (3rd) It stands corrosion and erosion better than the lighter belt hooks.

STEELGRIP comes in 6 sizes, in handy boxes or long lengths, with 2-piece hinged rocker pins that add flexibility and take the wear. It penetrates the toughest belt easily, clinches securely. Makes a permanent "humpless" joint. **Write for catalog sheets and name of local distributer.**

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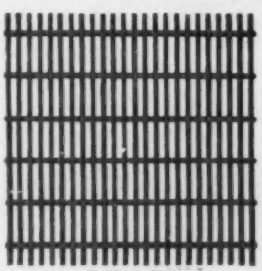

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ALLOY No. 2

STAR PERFORMERS

CLEVELAND SCREENS are star performers—returning larger capacities, increased profits and more accurate separations at lower cost. Cleveland Screens save money with the initial investment because, if they are made of the longer-wearing, wear-resisting ALLOY NO. 2—Cleveland Screens stay on the job long after ordinary screens would have been replaced.

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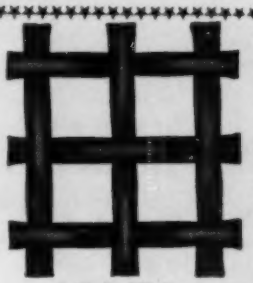

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Edelbute Mfg. Co., Reynoldsville, Pa.

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Construction Machinery Co., Waterloo, Ia.
Toledo Wheelbarrow Co., Toledo, O.

WINCHES
Alloy Steel & Metals Co., Los Angeles, Calif.
American Hoist & Derrick Co., St. Paul, Minn.
Bartlett, C. O., & Snow Co., Cleveland, O.
Continental Motors Corp., Detroit, Mich.
Dake Engine Co., Grand Haven, Mich.
INGERSOLL-RAND CO., New York, N. Y.
Jeffrey Mfg. Co., Columbus, O.
LINK-BELT CO., Chicago, Ill.
ROBINS CONVEYING BELT CO., New York, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.

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Audubon Wire Cloth Corp., Philadelphia, Pa.
BACON, EARLE C., INC., New York, N. Y.
CLEVELAND WIRE CLOTH & MFG. CO., Cleveland, O.
Columbia Steel Co. (U. S. Steel Corp. Subsidiary), San Francisco, Calif.
Deister Concentrator Co., Ft. Wayne, Ind.
EAGLE IRON WORKS, Des Moines, Ia.
Kennedy-Van Saun Mfg. & Engr. Corp., New York, N. Y.
Korb-Pettit Wire Fabrics & Iron Wks., Philadelphia, Pa.
LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
LINK-BELT CO., Chicago, Ill.
LUDLOW-SAYLOR WIRE CO., St. Louis, Mo.
Manganese Steel Forge Co., Inc., Philadelphia, Pa.
National Wire Cloth Co., Inc., St. Paul, Minn.
Pioneer Eng. Wks., Inc., Minneapolis, Minn.
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Roebling's, John A., Sons Co., Trenton, N. J.
SCREEN EQUIPMENT CO., Buffalo, N. Y.
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TYLER, W. S., CO., Cleveland, O.
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American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
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U. S. Rubber Products, Inc., New York, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

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Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
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Okonite Co., The, Passaic, N. J.
Roebling's, John A., Sons Co., Trenton, N. J.
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HAZARD WIRE ROPE CO., Wilkes-Barre, Pa.
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Sullivan Machy. Co., Michigan City, Ind.
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MACWHYTE COMPANY, Kenosha, Wis.
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American Hoist & Derrick Co., St. Paul, Minn.
American Steel & Wire Co., Cleveland, O. (U. S. Steel Corp. Subsidiary)
Bethlehem Steel Co., Bethlehem, Pa.
Broderick & Bascom Rope Co., St. Louis, Mo.
Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
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HAZARD WIRE ROPE CO., Wilkes-Barre, Pa.
Interstate Equipment Co., Elizabeth, N. J.
JONES AND LAUGHLIN STEEL CORP., Muncy, Pa.
LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
MACWHYTE CO., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
Union Wire Rope Co., St. Louis, Mo.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

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Columbia Steel Co., San Francisco, Calif. (U. S. Steel Corp. Subsidiary)
GILMORE WIRE ROPE DIV., Muncy, Pa.
HAZARD WIRE ROPE CO., Wilkes-Barre, Pa.
JONES AND LAUGHLIN STEEL CORP., Muncy, Pa.
LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
MACWHYTE CO., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
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WICKWIRE-SPENCER STEEL CO., New York, N. Y.

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LESCHEN, A., & SONS ROPE CO., St. Louis, Mo.
MACWHYTE CO., Kenosha, Wis.
Roebling's, John A., Sons Co., Trenton, N. J.
WICKWIRE-SPENCER STEEL CO., New York, N. Y.

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Broderick & Bascom Rope Co., St. Louis, Mo.
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WIRING DEVICES
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

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You will wish to keep this issue constantly available for you will find it handy, convenient and a great time saver when you are looking for new equipment.

If you do not find a listing for some particular piece of equipment address your inquiry to our Service Department. We maintain a complete file of all manufacturers' catalogs and will be happy to answer any questions pertaining to machinery, equipment or supplies.

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CONSOLIDATED GOOD USED EQUIPMENT

SELECTED SPECIALS

2—250 H.P. Ingersoll Rand Diesel Engine Generator Sets, 3/60/440 V.
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1—90 H.P. Lidgerwood double drum Gasoline Hoist.

JAW CRUSHERS:
10x15, 13x30, 15x30, 24x36 Farrel; 18x30, 24x36 Allis Chalmers; 30x60, 36x42 Traylor.

CRUSHING ROLLS:
1—42"x16" "B" Allis Chalmers, used one month; 24x14", 36x16" A-C; 20x14" Sturtevant; 30x10" Traylor; 24x24", 18x16" single roll crushers.

ROTARY KILNS and DRYERS:
20—Rotary Dryers; 3'6x20 with oil furnace, 4x30, 5x30, 6x40, 6x50, 6x60, 8x60, 9x85'. Rotary Kilns; 3'6x20, 4x30, 6x40, 6x60, 7x100, 8x125, 9'6x150'.

AIR CLASSIFIERS:
10' Sturtevant; 12' Gayco.

PULVERIZERS:
Raymond 4 and 5 roll high and lose side, also two No. 60 Imp. and rigid beater types; 24" Mikro; and other types.

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1—5'x36' Vulcan three-compartment iron lined, used three days; 6'x22" Hardinge, 3x12' Hendy, 5x22' Gates, all iron lined; 5x16' Marcy, 6'x12' Hardinge Rod Mills.

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Reconditioned pipe, new threads and couplings, all sizes, ¾ in. to 36 in., guaranteed suitable for all practical purposes.

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RUBBER BELTING

Transmission ◦ Conveyor ◦ Elevator

"V" BELTS
for
Pumps ◦ Crushers ◦ Pulverizers, etc.

RUBBER HOSE
for
AIR ◦ WATER ◦ STEAM, ETC.

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CARLYLE RUBBER CO., Inc.
64 Park Place — New York, N. Y.

CRUSHING ROLLS—72 x 20" Garfield type, 42 x 16" type B Allis Chalmers, 36 x 16" Kennedy Van-Saun.
JAW CRUSHERS—4 x 8" Sturtevant, 7 x 10" Dodge Type Allis Chalmers, 9 x 15", 36 x 18", 24 x 36" Farrel.
RAYMOND MILLS—No. 0000, No. 00, 4 roll, High Side.
AIR COMPRESSOR—Ingersoll-Rand, 2 stage, with 206 H.P. Westinghouse motor, 1257 C.F.M. at 100 lb. pressure.
GYRATOR CRUSHER—Traylor Type "T" Bulldog, 8" opening.
AIR CLASSIFIERS—Gayco & Sturtevant, 30", 3' and 8'.
VIBRATING SCREENS—Tyler Hummer 2- and 3-deck.
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CRUSHERS—Sturtevant No. 1 Ring Roll Mill, No. 0 Rotary Fine Crusher.
KILNS—6' x 60', 8' x 125', 9' x 142'.
DRYERS—American Process 5'6" x 48' direct heat, Ruggles Cole 8'6" x 84' double shell.

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BRILL EQUIPMENT CORPORATION
183 Varick Street
NEW YORK, NEW YORK

40 TON CAP. INDUSTRIAL LOCOMOTIVE CRANE

Type "L", 70' boom, outriggers.
Also
1—25 ton cap. Model "E" OHIO.
1—20 ton cap. BROWNHOIST.
1—20 ton cap. LINK BELT.
All 8 wheel, steam.

PHILIP T. KING, *"The Crane Man"*
50 Church St. — New York

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New Elevator Buckets of all sizes. Also Bins and Tanks, Bolted or welded.

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Liberty Trust Bldg. — Roanoke, Virginia

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Roller Bearing, troughing and return idlers, 3 roll,—for 30" belt.

FOR SALE

2—Link-Belt dewatering elevators, 36' centers, complete with all steel supporting structure and drive machinery.
2—Strut bar, revolving, scalping screens, 48" diameter, 12' long, with drive machinery.

TERRE HAUTE GRAVEL COMPANY
TERRE HAUTE, INDIANA

STANHOPE OFFERS

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BELTED: 355, 528, 676, 1000, 1300 & 1570 Ft.
ELECTRIC: 478, 676, 807, 1302, 1722 & 2280 Ft.
DIESEL: 603, 807 & 1060 Ft.
PORTABLE GAS: 110, 160, 220, 310 & 540 Ft.
STEAM: 49, 310, 528 & 1300 Ft.

CLAMSHELL BUCKETS AND SKIPS
2 Yd. OWEN Type S Material Handling.
1½ Yd., 1 Yd. & ¾ Yd. HAYWARD Class E.
48 Steel Skips 6½ x 6 x 2½.

CRANES & DRAGLINES
⅝ Yd. 5 Ton Brownhoist 30 Ft. Boom.
1½ Ton NORTHWEST 50 Ft. Boom Gas.
25 Ton BROWNING & 20 Ton AMERICAN Locos.
25 Ton LINK BELT K-42 Electric, 70 Ft. Boom.

CATERPILLAR SHOVELS
⅜ Yd. BYERS Electric.
⅜ Yd. KOEHRING Gasoline.
¾ Yd., 1¼ Yd. & 2 Yd. MARION Electrics.
1 Yd. NORTHWEST Gas.
1½ Yd. BUCYRUS 41B Steamer.
4 Yd. Bucyrus 120 Electric.

DUMP CARS
46—KOPPEL 1½ Yd. 24 & 30 in. Ga., V Shaped.
15—2 Yd., 3 Yd., 4 Yd. 36 In. Ga.
20—Std. Ga. 12 Yd., 16 Yd. & 20 Yd. Cap.
15—Std Ga. 50 Ton Battleship Gondolas.

FLAT CARS
30—5 ton capacity 36" Ga. Flat Cars.
9—50 ton std. ga. heavy duty flat cars.

BALL, ROD AND TUBE MILLS
3' x 8" & 5' x 22" HARDINGE CON. Dry Ball Mill.
3' x 36" HARDINGE CONICAL Wet Ball Mill.
6' x 22" HARDINGE CONICAL Pebble Mill.
3' x 22" HARDINGE CONICAL Ball or Pebble Mill.
4x8, 8x6 & 10x9 Straight Ball Mills.
4x16, 5x18 & 5x22 Tube Mills.
3½x8 & 5x7 Air Swept Tube Mills.
2x4½, 3x10 & 5x12 ROD MILLS.

PULVERIZERS
JEFFERY 24 x 20 Hammer Mill.
RAYMOND Auto. Pulverizer No. 0000, 0 & 3.
RAYMOND Imp Mills No. 4, 32 & 35.
GRUENDLER XXB Mill & Jay Bee No. 3 & 4.
RAYMOND 4 & 5 ROLL MILLS.

STEEL STORAGE TANKS
10,000 Gal., 15,000 Gal. & 20,000 Gal. Cap.

400 BARREL CEMENT BIN
400 Barrel Butler Portable Steel Cement Bin with Fuller automatic batcher, push button control, including motor.

SEPARATORS AND COLLECTORS
Gayco 5 ft. and 12 ft. Separators
Type 380 Sly 8x24, 8x52 and 10x42 Dust Collectors.

ROLL CRUSHERS
36x60 Fairmount & 36x16 Allis Chalmers.
24x12 Power & Mfg. Smooth Roll.

JAW CRUSHERS
10x8, 13x7½, 14x7, 15x9, 15x10, 16x9, 16x12, 16x16, 18x11, 20x8, 20x6, 20x10, 20x12, 20x11, 24x12, 30x15, 30x13, 36x30, 36x18, 36x14, 36x9, 36x6, 38x18, 36x16, 26x24, 42x9, 48x36, 60x42, 84x66, 36x16, 9x36, 12x26 Champion, Screen & Elevator.

CONE & GYRATORY CRUSHERS
18 in., 24 in., 30 in., 36 in. and 48 in. Symons Disc.
4—10 TZ Traylor 4 ft. Gyratory.
4—Nos. 5, 3 & 6 Austin Gyratory.
2—Traylor T-12 Bulldog Gyratory.
8 in. Traylor T. Gyratory.
17 Gates K—Nos. 3, 4, 5, 6, 7½, 8 & 9½.
10 Inch Austin Model 105.
10 & 13 Inch Superior McCully.

BUCKET ELEVATORS
7 Steel Encased Chain & Belt Elevators:
15 In. by 60 ft., 24 In. by 63 ft., 18 In. by 48 ft., 12 In. by 30 ft.
ELEVATOR BELT: 600 Ft., 30 In.—1326 Ft. 20 In. & 18 In.

CONVEYOR PARTS
BELT: 1000 Ft. 60 In., 700 Ft. 40 In., 600 Ft. 36 In., 800 Ft. 30 In., 1642 Ft. 24 In., 517 Ft. 20 In., 297 Ft. 18 In., 500 Ft. 16 In., 200 Ft. 14 In.
IDLERS: 54 In., 42 In., 36 In., 30 In., 24 In., 20 In., 18 In.
Head & Tail—Pulleys—Takeup for all sizes.
Steel Frames: 2,000 ft. 24 In., 30 In. & 36 In. Sections.

ROTARY DRYERS AND KILNS
36 In. x 20 Ft., 3 Ft. x 30 Ft., 4 Ft. x 30 Ft., 54 In. x 30 Ft., 42 In. x 24 Ft., 5 Ft. x 30 Ft., 5 Ft. x 16 Ft., 5 Ft. x 60 Ft., 6 Ft. x 60 Ft., 6 Ft. x 70 Ft., 70 In. x 40 Ft.

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GUY: 8 Ton 85 Ft. Boom, 15 Ton 100 Ft. Boom. 20 Ton 115 Ft. Boom, 50 Ton 100 Ft. Boom.
STIFF LEG: 5 Ton 70 Ft. Boom, 15 Ton 100 Ft. Boom, 25 Ton 100 Ft. Boom, 75 Ton 125 Ft. Boom.

LOCOMOTIVES
GASOLINE: 3 Ton, 5 Ton, 8 Ton, 12, 14, and 30 Ton.
STEAM: 9 Ton, 20 Ton, 40 Ton, 60 Ton.
ELECTRIC: 2 Ton, 5 Ton, 8 Ton, 40 Ton.

SCREENS
VIBRATING: 2x4, 3x6, 12x8, 3x8, 3x5, 4x5, 4x8, 4x10, 48x72 & 4x12.
HUMMER, ROTEX, NIAGARA & ROBINS.
REVOLVING: 3x12, 3x16, 3½x18, 3x24, 4x16, 4x20, 4x22, 4x24, 5x30, 5x20, 6x20.

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CONSULTATION REPORTS

BUYERS' FREE SERVICE

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We are in the market for and would like to receive prices and literature on the items checked below:

- ....Admixtures
- ....Aerial Tramways
- ....Aggregates (Special)
- ....Agitators
- ....Air Compressors
- ....Air Separators
- ....Architectural Trimstone Molds
- ....Ash Receptacle Molds
- ....Ash & Refuse Handling Equipment
- ....Asphalt Mixing Plants
- ....Backdiggers
- ....Backfillers
- ....Bags
- ....Bagging Machines
- ....Balls (Grinding)
- ....Barges
- ....Batchers (Weighing)
- ....Bearings
- ....Belting (Conveyor & Elevator)
- ....Bins (Storage)
- ....Blasting Supplies
- ....Block Machines, Building
- ....Boats
- ....Brick Machines & Molds
- ....Buckets
- ....Building Tile Machines
- ....Bulk Cement Batching Plants
- ....Bulk Cement Storage Plants
- ....Bulldozers
- ....Bullscrapers
- ....Burial Vault Forms
- ....Calcining Equipment
- ....Calcium Chloride
- ....Cars (Industrial)
- ....Catch Basin Block Machines
- ....Cement Plants
- ....Cement Colors
- ....Cement Process
- ....Central Mixing Plants (Concrete)
- ....Chimney Block Machines & Molds
- ....Clarifiers
- ....Classifiers
- ....Coal Pulverizing Equipment
- ....Concentrators
- ....Concrete Mixers
- ....Concrete Paints & Coatings
- ....Concrete Waterproofing & Dampproofing
- ....Conveyors
- ....Conveyor Idlers and Rolls
- ....Coolers
- ....Corn Crib Block and Tile Machines
- ....Correcting Basins
- ....Cranes (Crawler & Locomotive)
- ....Crushers
- ....Crushing & Screening Plants (Portable)
- ....Culvert Pipe Machines & Molds (Concrete)
- ....Curing Equipment
- ....Curb Forms (Concrete)
- ....Dedusters
- ....Dehydrators
- ....Derricks
- ....Dewatering Equipment
- ....Dippers & Teeth
- ....Disintegrators
- ....Dragline Cableway Excavators
- ....Drain Tile Machines
- ....Dredges
- ....Dredge Pumps
- ....Drills (Rock)
- ....Drill Bits
- ....Drill Sharpening Machines
- ....Drill Steel
- ....Dryers
- ....Dust Collecting Systems
- ....Dust Precipitators
- ....Dust Recovery Plants
- ....Dynamite
- ....Electric Motors
- ....Electrostatic Separators
- ....Elevators
- ....Engineering Service (Consulting & Designing)
- ....Engines (Diesel, Gasoline, Steam)
- ....Feeders
- ....Fence Post Molds & Machines (Concrete)
- ....Floor Tile Machines (Concrete)
- ....Garbage Receptacle Molds (Concrete)
- ....Garden Furniture Molds (Concrete)
- ....Generators & Motor Generator Sets
- ....Greenhouse Bench Forms (Concrete)
- ....Guns (Hydraulic)
- ....Gutter Block Machines (Concrete)
- ....Hoists
- ....Hoppers
- ....Hose
- ....Hydrators (Lime)
- ....Joist & Slab Machines (Concrete)
- ....Kilns (Rotary, Shaft, Vertical)
- ....Laboratory Apparatus
- ....Laundry Tub Molds (Concrete)
- ....Light Post & Standard Forms
- ....Lime (Hydrated)
- ....Lime Handling Equipment
- ....Lime Plants
- ....Lime Putty Plants
- ....Loaders
- ....Locomotives
- ....Mills (Ball, Compartment, Emery, Hammer, Rod, Roll, Tube)
- ....Mortar Mixers
- ....Pallets (Steel, Wood)
- ....Pans, Grinding (Wet & Dry)
- ....Perforated Metal
- ....Pipe Molds and Machines (Concrete)
- ....Pipe
- ....Plaster Mixers
- ....Pontoons
- ....Pulverizers
- ....Pumps (Pulverized Material)
- ....Railway Equipment
- ....Rectifiers
- ....Recuperators
- ....Refractories
- ....Rewashers (Screw)
- ....Rock Wool Cupolas
- ....Roofing Tile Machines
- ....Sand Drags
- ....Sand & Gravel Plants
- ....Sand Lime Brick Machinery
- ....Sand Settling Tanks
- ....Scales
- ....Scrapers (Power Drag)
- ....Screens (Revolving, Vibrating, Etc.)
- ....Seal Rings
- ....Septic Tank Molds (Concrete)
- ....Sewer Pipe Machines (Concrete)
- ....Shale Planers
- ....Shovels (Power)
- ....Sidewalk Forms
- ....Silo Forms (Concrete)
- ....Silos (Storage)
- ....Silo Stave Machines
- ....Slakers (Rotary)
- ....Slurry Mixers
- ....Slurry Pumps
- ....Slurry Separators
- ....Slurry Thickeners
- ....Step Forms (Concrete)
- ....Tampers (Hand & Power)
- ....Tanks (Storage)
- ....Tractors
- ....Trucks (Agitator)
- ....Trucks (Dump)
- ....Trucks (Industrial)
- ....Trucks (Mixer Body)
- ....Unloaders
- ....Unloaders (Boat)
- ....Unloaders (Box Car)
- ....Wagons (Dump)
- ....Wall Forms & Machines (Concrete)
- ....Washers (Sand, Gravel & Stone)
- ....Welding & Cutting Equipment
- ....Well Curbing Machine & Molds (Concrete)
- ....Wire Cloth
- ....Wire (Copper, Iron & Steel)
- ....Wire Rope

Firm Name _____
Individual _____ *Title* _____
Address _____
City _____ *State* _____

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While the Drum Revolves, You Can SEE What's Going On!

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• • •

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THE *Modern* TRUCK MIXER and AGITATOR

A 2420-½

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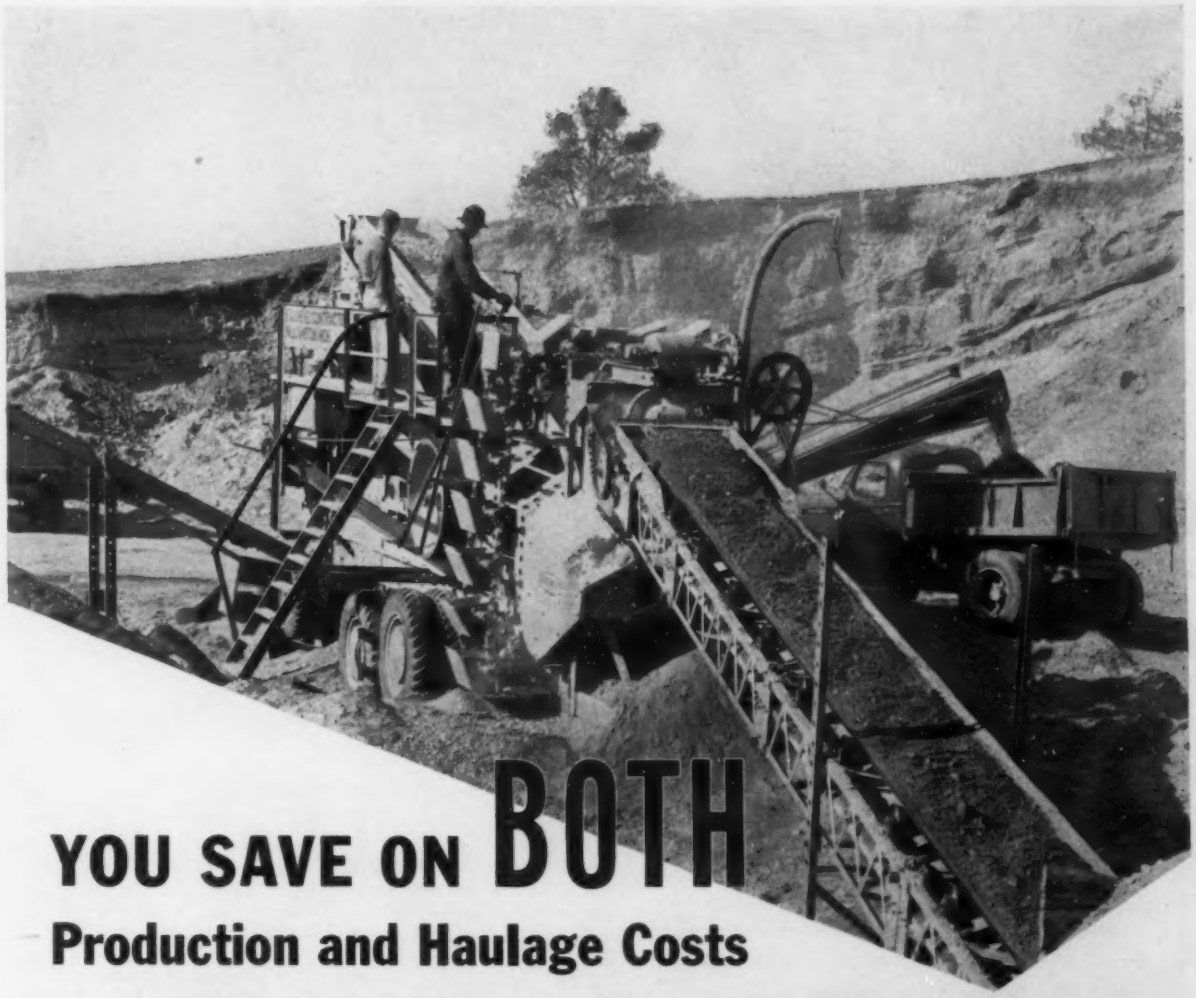

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1927
1929
1936
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1938
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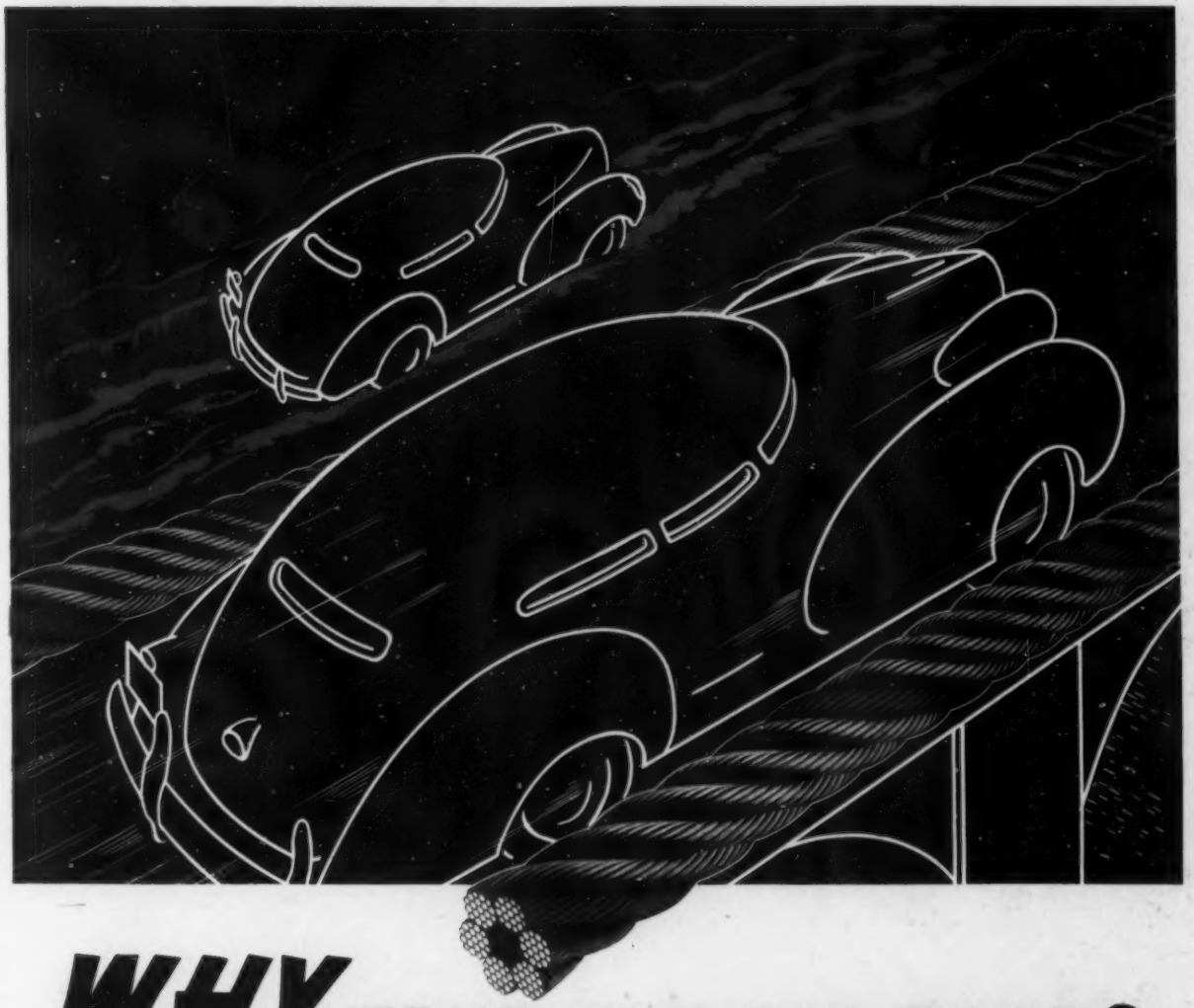

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